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Kew. ROYAL BOTANIC GARDENS, KEW.

# BULLETIN

OF

# MISCELLANEOUS INFORMATION.

## 1892.

Mo. Bot. Garden,
1893

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ROYAL GARDENS, KEW.

# BULLETIN

OF

# MISCELLANEOUS INFORMATION.

No. 61.] JANUARY. [1892.

## CCXXIII.—AGAVES AND ARBORESCENT LILIACEÆ ON THE RIVIERA.

At the close of November 1891 Mr. J. G. Baker, F.R.S., keeper of the herbarium and library, paid a short visit to the gardens of the Riviera for the purpose of studying the plants of Agave and allied genera, and the plants of such Arborescent Liliaceæ as had been successfully introduced into cultivation in that part of the world. It will be recollected that in the *Kew Bulletin* for December 1889 an interesting account was published of the general characteristics of the plants of the Riviera, prepared by the Assistant Curator, Mr. W. Watson. The following notes, prepared by Mr. Baker, deal with the plants of a few groups only. They are, however, of so much general importance that the results of Mr. Baker's observation will be read with interest:—

The principal object of a visit which I made in November–December 1891, at the instigation of the Director, to the gardens of the Riviera, was to see the Agaveæ and arborescent Liliaceæ growing there in quantities in the open air. I have for some time devoted special attention to these two groups of plants, and have written papers upon them in which I have endeavoured to work out and characterise the species and varieties. In these large plants very little help can be obtained from herbarium materials, and the species have been mostly described and their range of variation studied from a small number of specimens grown in the conservatories of England, France, Germany, and Belgium. It is quite obvious that the range of specific variation is often far greater than was supposed when they were first named and characterised, and that often the descriptions have been made from plants in a state of very imperfect development. Very few botanists have attended much to these plants, so that it has often been very difficult for cultivators to obtain names for their specimens. I also wished to get any further light I could upon the differences in the climatic requirements of the species. I was kindly invited by Mr. Thomas Hanbury, F.L.S., of the Palazzo Orengo, La Mortola, who has the largest collection of these plants on the Riviera, to pay him a visit. I stayed at his house more than a week, and had therefore full opportunity of studying all the

forms contained in his collection in a leisurely manner; and he kindly also took me to a number of other gardens at Mentone, Monte Carlo, Bordighera, and San Remo. I also went with him to Genoa to see the magnificent botanical institute which he has recently founded there, and had the opportunity of going with Professor Penzig through the Genoa botanic garden. I worked for a day making notes upon the collection in the Jardin d'Acclimatisation at Hyères, which, next to that of Mr. Hanbury, contains the largest series of forms on the Riviera. In the following paper I propose to give a complete list of the species which I saw growing in the open air, which appeared to be fully adapted to the soil and climate of the Riviera, with a summary of the notes which I made upon any points about their characters and development which are not already known and placed on record. Besides studying the plants I took note of all the names I saw, and these names were often wrongly applied. These corrections will be a great help to us at Kew in the interchange or purchase of further specimens for our collection, but it is needless, in the present paper, to enter into full details on this part of the subject. For the nomenclature and classification of the *Agaveæ* I follow my "Handbook of the *Amaryllideæ*," published in 1888, and for the *Aloineæ* and *Yuccoideæ* my paper in the 18th volume of the "Journal of Linnean Society," published in 1880.

Order Amaryllideæ.

Genus Agave, Linn.

Group Filiferæ.

*A. filifera*, Salmdyck. Grown abundantly all along the Riviera, from Hyères to Genoa, in a great variety of forms, flowering freely. It does not differ materially from the plant of English conservatories. It is quite clear that *A. filamentosa*, Salmdyck, is a mere form of the same species.

*A. schidigera*, Lemaire. La Mortola, just the plant of English conservatories. It is very doubtful whether this is more than a variety of the last.

Group Marginatæ.

*A. lophantha*, Schiede. Seen in various forms, both the type and *A. cærulescens*, Salmdyck, under a great variety of names, but not in flower. What is grown as "*stenophylla*" is not the plant described under that name by Jacobi, but a form of this species. I do not think *lophantha* is really distinct specifically from *A. univittata*, Haworth, which has long green leaves, with a pale band down the middle.

*A. xylonacantha*, Salmdyck. The true plant is grown at La Mortola, not differing materially from that of English conservatories; but I saw a great many others so called, which were wrongly determined.

*A. Kerchovei*, Lemaire. Grown sparingly both at La Mortola and Hyères, at the latter garden as "*A. Beaucarnei*, Lemaire," not differing materially from the plant of English conservatories. A very curious plant grown at La Mortola, under the name of "*A. Villæ*, Pirotti," is, I think, a very dwarf, spineless form of this species, identical with what has been called in England "*A. Kerchovei inermis*."

*A. Victoriæ-reginæ*, Moore. Seen at La Mortola, not differing materially from the plant of English conservatories. Has not flowered.

*A. Gheisbreghtii*, Lemaire. Seen at La Mortola, not differing materially from the plant of English conservatories.

*A. Hanburii*, Baker, n. sp. A new species, allied to *A. Gheisbreghtii*, seen in the Mortola collection, under the name of *A. heteracantha*. It has a sessile rosette, 8–9 inches in diameter, oblong rigid very glaucous leaves 4–5 inches long, 2½ inches diameter at the middle, with a very concave face, a pungent brown-black end-spine, a narrow continuous brown border, and close spreading colourless deltoid teeth, ¼ inch long. Flowers not seen.

*A. horrida*, Lemaire. Seen at La Mortola, not differing materially from the plant of English conservatories.

## Group Submarginatæ.

*A. Deserti*, Engelm. Seen only in an undeveloped state at La Mortola.

*A. Shawii*, Engelm. Seen only in an undeveloped state at Hyères.

*A. applanata*, Lemaire. A most striking species, which I saw all along the Riviera, from Hyères to Genoa, reaching a much fuller state of development than we ever get in England. Leaves 30–40 in an acaulescent rosette, very rigid, oblong, very glaucous, reaching a length of 4–5 feet, and a breath of 4–6 inches at the middle; base very convex, 1½ inches thick; end-spine very large and pungent, decurrent along the margin a third or half way down; teeth distant, deltoid-cuspidate, dark brown, ¼–⅓ inch long. It flowers freely at La Mortola and elsewhere, with a peduncle 10 or 12 feet long. *A. spectabilis*, Todaro Hort. Bot. Panorm. II. t. 25, is probably the same species.

*A. Hookeri*, Jacobi. A fine plant from Mexico, without a name, which had just flowered at Hyères, I referred here. It had 30–40 very thick, rigid, bright green, oblong leaves, 3–4 feet long, 6–8 inches broad at the middle, a decurrent large pungent end-spine, very broad deltoid-cuspidate teeth, and a stout peduncle, 20 feet long, with large crowded lanceolate bract-leaves, imbricating like those of *A. atrovirens*. It flowered at Kew in 1889, and was figured in the *Botanical Magazine*, tab. 6589.

*A. Franzosini*, Hort. Hanbury. This, which is one of the most striking plants in Mr. Hanbury's garden, was one of the things which I was desirous to see, and I find that it is an undescribed species of this affinity, which I have never seen in any English collection. It has an acaulescent rosette of 30–40 oblong-spathulate leaves, which are as thoroughly and persistently glaucous as those of *A. applanata*, reaching a length of 8–9 feet and a breadth of a foot at the middle, very rigid in texture, with a very pungent end-spine decurrent for about half a foot, and distant dull brown-black deltoid-cuspidate hooked or straight teeth, ⅓–½ inch long. It was not in flower at the time of my visit, but its huge *Euagave* panicle was produced a year ago, with a stout peduncle 40 feet long, and was described fully in a paper by Philip Sewell in Gard. Chron., 1889, Vol. II., p. 639. Mr. Hanbury tells me it was introduced to La Mortola in 1878, and probably named in honour of Francesco Franzosini, proprietor of the Villa Franzosini and a rich garden at Intra on the Lago Maggiore, which was rented for some years by the late Sir G. Macleay.

*A. atrovirens*, Karw. Next to *americana* and *rigida*, this is the most abundant Agave of the Riviera gardens, attaining a much greater development than it ever reaches at home. It may be recognised through

all its wide range of variation by its large oblong-spathulate dull green leaves, large decurrent end-spine, large distant deltoid-cuspidate marginal teeth, stout peduncle with crowded ascending imbricating lanceolate bract-leaves, the lower a foot or a foot and a half long, and very stout comparatively short panicle branches. I saw it in flower at Hyères, La Mortola, and San Remo. The leaves reach a length of six or eight feet, and a breadth of 15–16 inches. On the Riviera it is usually called *A. Salmiana*, but I believe that quite a dozen plants named or maintained as species by Jacobi must range here as forms.

## Group Americanæ.

*A. seemanniana*, Jacobi. This I saw at Hyères just coming into flower, not differing very materially from the plant of English conservatories.

*A. ferox*, K. Koch. This species, grown in the open air at La Mortola, is developed much better than any I have seen at home. It has slightly glaucous oblong-spathulate leaves, 3 feet long, 9–10 inches broad at the middle, a large pungent non-decurrent end-spine, and very large irregular deltoid-cuspidate marginal teeth, with the edge hollowed out between them. I did not see it in flower.

*A. Scolymus*, Karw. Not grown commonly in the Riviera gardens, but I saw it at Hyères, La Mortola, and Monte Carlo, in flower at the last locality. *A. Verschaffeltii*, Lemaire, and several other plants which have been described as species, must clearly be placed here.

*A. potatorum*, Zucc. What was called by this name at La Mortola, and it may be named correctly, was clearly conspecific with *A. atrovirens* (*Salmiana*).

*A. coccinea*, Roezl. Grown at La Mortola, not differing materially from the plant of English conservatories.

*A. mexicana*, Lam. The plant grown under this name at Hyères is no doubt named correctly, but I do not think in any broad sense it is more than a variety of *americana*.

*A. americana*, L. Everywhere abundant along the Riviera, not in gardens only, but by roadsides, and along the sea margin, flowering very freely. Besides the type, two varieties, one of which is called *lætevirens* and *Milleri*, with very glaucous leaves, approximating towards *mexicana*, and another called *ornata* and *picta*, with green leaves with great stripes of yellow. I saw one plant of the latter with leaves 8-9 feet long and nearly a foot broad at the middle.

## Group Rigidæ.

*A. rigida*, Miller. This, the most valuable and most variable of all the Agaves, is common and quite at home in the Riviera gardens, flowering freely; and I had an opportunity of studying its characters and range of variation far better than I had ever done before, and of seeing several forms with which I was not previously acquainted. The commonest forms in the Riviera show the characteristic small distant, nearly black teeth, and agree very well with what has been described and figured as *Ixtli* and *ixtlioides* (Bot. Mag., t. 5,893). In Dr. Hern's garden, situated just on the French side of the boundary gorge at St. Louis, I saw a form with leaves much thicker than usual (1½ inches thick at the base) and forming a less dense rosette. The plants called *Cantala* and *Rumphii* in the Riviera gardens are forms of

*rigida.* Mr. Hanbury has just flowered a spineless form that agrees very well with the *sisalana* of Yucatan and Florida. I am quite satisfied now that *A. Houlletii*, Jacobi, is nothing more than undeveloped *sisalana*, and the same holds good with a plant called *lævis.* One panicle of this species at La Mortola was producing copious bulbillæ. The peduncle, including the rhomboid panicle, does not reach a greater height than 12–15 feet. The bract-leaves, like those of *americana*, are small and distant as compared with those of *atrovirens.*

*A. Davilloni*, Baker, n. sp. This is a new species, intermediate between *rigida* and *polyacantha*, which I saw for the first time in the Jardin d'Acclimatisation at Hyères. It is acaulescent, with a rosette of about 30 rigid ensiform leaves, which reach a length of 3–4 feet and a breadth of 4 inches at the middle. They are moderately glaucous when mature, tinged with red when young, very concave on the face towards the tip, with a non-decurrent pungent point and close minute deltoid chestnut-brown marginal teeth. The peduncle was about 20 feet long, and the panicle 6 feet long and broad. The bract-leaves and flowers are like those of *A. rigida.*

*A. lurida*, Miller. Seen only at Hyères, not differing materially from the plant of English conservatories.

*A. troubetskoyana*, Hort. Hyères. A very fine plant, allied to *A. lurida*, which I saw, under this name, in the Jardin d'Acclimatisation at Hyères, is quite distinct from anything I have seen at home. It is acaulescent, with about 30 lanceolate very glaucous leaves, 9–10 feet long, 6–7 inches broad above the middle, very thick and rigid in texture, with a large pungent non-decurrent end-spine, and small distant nearly black deltoid marginal teeth. I was informed that it had been received from De Smet of Gand, and named in honour of Prince Troubetskoy, who some years ago had a very fine garden on the Lago Maggiore near Pallanza.

*A. miradorensis*, Jacobi. A plant which I saw under this name at Hyères, differs considerably from what we have at home, but is probably a variety of the same species. It has very glaucous lanceolate rigid leaves, 2 feet long, 4–5 inches broad at the middle, a small pungent black non-decurrent end-spine, and indistinct very small marginal teeth.

*A. polyacantha*, Haworth. Seen both at La Mortola and Hyères under a great variety of forms and in different stages of growth. When fully developed it has an acaulescent rosette of about 40 lanceolate leaves of firm texture, measuring about 3 feet long by 4 inches broad at the middle, green, with a slight glaucous tinge, a small non-decurrent pungent red-brown end-spine, and copious close minute red-brown deltoid marginal teeth. The peduncle is about 5 feet long, with many small scariose bract-leaves, which are linear from a broad base, and the dense spike is about as long as the peduncle. In a young state the brown horny border is quite continuous, so that it is quite probable that this may be *A. Keratto*, Miller, received by him from the island of St. Kitts. A curious form seen at Hyères has more ensiform leaves than in the type, curved forward in the plane of the face, like a sickle. Plants which I saw labelled *xalapensis*, *chiapensis*, *densa*, and *cubensis* were all *polyacantha* forms.

*A. densiflora*, Hook. After seeing the wide range of *polyacantha* forms just described, I cannot now separate *densiflora* as a species.

### Group Striatæ.

*A. striata*, Zucc. Frequent in the Riviera, with a range of variation similar to what we know already at home. Here belong the plants

called *Bonapartea rigida*, *B. striata*, and *B. hystrix*, but what are called *Bonapartea gracilis* and *B. gracilis glauca* belong to *Dasylirion*.

*A. dasylirioides*, Jacobi. Had just flowered at La Mortola. *A. dealbata*, Lemaire, is substantially identical with Jacobi's plant.

### Group Integrifoliæ.

*A. Houlletii*, Jacobi. As already stated, this cannot remain in this group, but is *A. rigida*, var. *sisalana*, in an imperfect state of development.

### Group Geminifloræ.

*A. geminiflora*, Gawl. Is grown at La Mortola under the name of *Littæa geminiflora*. This does not differ materially from the plant of English conservatories.

### Group Aloidæ.

*A. Celsiana*, Hook. Seen at Hyères only, just like the form grown at Kew.

*A. mitis*, Salmdyck. Gets better developed at La Mortola than any I have seen in England. Shortly caulescent ; leaves lanceolate, 2 feet long, 4 inches broad at the middle, green, with a slight glaucous tinge; tip small, not pungent; teeth very minute, coloured brown in the sun, remaining green when in the shade.

*A. albicans*, Jacobi. Seen at La Mortola only. I do not think it can stand as more than a glaucous-leaved variety of *A. micracantha*.

*A. chlorocantha*, Salmdyck. Seen at La Mortola in a young state.

### Group Attenuatæ.

*A. elemeetiana*, Jacobi. A plant seen at La Mortola, agreeing well with what we have at Kew.

*A. attenuata*, Salmdyck. Has lately flowered at La Mortola, with a cernuous spike 8–9 feet long, and a peduncle about half as long.

### Group Yuccæfoliæ.

*A. yuccæfolia*, DC. Seen both at Hyères and La Mortola, flowering freely and better developed than we get it in England. Leaves linear, 3 feet long, 1½ inches broad at the middle, tapering gradually to a long point not pungent at the apex, obscurely serrulate on the margin. Peduncle wand-like, 4–5 feet long, with only a few distant small scariose bract-leaves, linear from a broad base. Spike dense, 3 feet long. Capsules very small, turbinate.

*A. spicata*, Cav. One of the things that interested me most at La Mortola, was to find growing in full perfection an *Agave* which cannot be anything else than this species, which was described by Cavanilles in 1802 from a plant from Cuba, which flowered in the Botanic Garden at Madrid and has not been heard of since. It is a very distinct species, nearly allied to *A. yuccæfolia*, with about 20 oblong-lanceolate leaves in an acaulescent tuft, which are bright green, 2 feet long, nearly 3 inches broad at the middle, with a small non-pungent end-spine and very close minute greenish-white marginal teeth. In the La Mortola

plant the peduncle and bracts were just like those of *yuccæfolia*, the spike 3–4 feet long, and the oblong capsule an inch long, dehiscing loculicidally to the base.

Genus Furcræa, Vent.

*F. gigantea*, Vent. The typical form is quite at home at La Mortola in the open air, with bright-green glossy rigid ensiform leaves, 4–5 feet long, with all the inner leaves of the rosette entire, but the outer with a few irregular teeth about the middle of the blade. I did not see *F. cubensis* or any of its allies anywhere on the Riviera, except young plants just received at La Mortola from Kew.

*F. pubescens*, Todaro. Seen at La Mortola in a young state.

*F. Bedinghausii*, K. Koch. Frequent in the Riviera gardens from Hyères to Genoa. The caudex is always short, the leaves reach a length of 4 feet, and are persistently very glaucous and scabrous on the under surface. I saw it in flower in two gardens at Mentone, producing copious bulbillæ. At Hyères it was labelled *Roezlia regia*. I do not think *F. Roezlii*, André, can be a distinct species.

Genus Doryanthes, Correa.

*D. excelsa*, Correa. Is grown at La Mortola and elsewhere in the open air, but I do not think it has ever flowered.

Genus Beschorneria, Kunth.

*B. viridiflora*, Hort. Hanbury. Leaves oblong-lanceolate, 3 feet long, 3–4 inches broad at the middle, glaucous green, scabrous on the under surface. Peduncle about 2 feet long; panicle 3–4 feet long, central branches nearly a foot long, each branch bearing at its apex a few corymbose flowers; bracts large ovate; pedicels 1½–2 inches long. Capsule oblong-trigonous, 1½ inches long, dehiscing loculicidally to the base. This is probably *B. yuccoides* (Hook in Bot. Mag. t. 5,203) in a state of full development.

Order Liliaceæ.

Genus Yucca Linn.

*Y. aloifolia*, Linn. Common all along the Riviera, flowering and fruiting freely. The typical form has stems 6 or 8 feet long, green rigid ensiform leaves, 1½ feet long, 1½ inches broad at the middle, with a pungent point, a channelled face and a very scabrous margin, a short peduncle, a rhomboid panicle 1½–2 feet long, and glossy bright red-brown indehiscent oblong fleshy fruits, 2½–3 inches long, 1½ inches diameter.

*Y. guatemalensis*, Baker. This is one of the commonest species along the whole Riviera, in a great variety of forms, and I had the opportunity of studying it far more fully than I had been able to do before. It is usually called *Y. Draconis*, but is not the plant of Linnæus, which is founded upon a figure in the "Hortus Elthamensis" of Dillenius. It gets up to a height of 15 or 20 feet, sometimes branching from low down. I saw a tall one at Genoa with 15–20 branches, each ending in a great tuft of leaves. The leaves are always bright green, and reach a length of 3–4 feet. *Y. Gheisbreghtii* recedes from the type in the direction of *aloifolia* by its rigid scabrous leaves. *Y. Mazelii* and *Y. lenneana*, on the other hand, have less firm recurving leaves, and the

marginal toothing is sometimes very obscure, and there is a trace of a brown border. *Y. conspicua*, of the Riviera gardens, is also a form of this species, and I have very little doubt now that *Y. gigantea*, Lemaire, which I know from description only, must also range here. It produces flowers copiously on the Riviera, but never ripens its fruit.

*Y. desmetiana*, Baker. This is evidently a distinct species, which attains a greater size on the Riviera than with us at home, but has not been known to flower. The finest plant I saw was in the garden of the Baroness von Huttner at San Remo, 5–6 feet high, the branching stems 3 inches in diameter, the recurving leaves a foot and a half long, 1½ inch broad.

*Y. Peacockii*, Baker. Grown at La Mortola, but has not yet flowered.

*Y. gloriosa*, L. Not common in the Riviera; but I saw several forms at Hyères. *Y. pendula*, Siebold, is substantially the same as our *recurvifolia*. *Y. brasiliensis* is a form with much recurved very glaucous leaves. *Y. glaucescens*, Carrière, is a form of *gloriosa*, and quite different from Haworth's plant so called.

*Y. macrocarpa*, Engelm. This I saw alive for the first time at La Mortola. It was acaulescent, with a great tuft of very rigid glaucous ensiform leaves, 2 feet long, 1 inch broad at the middle, with a very pungent apex and a narrow brown margin without any threads. It has not yet flowered.

*Y. treculeana*, Carriere. This is grown along the whole Riviera, reaching a development far beyond anything which we have at home. In a plant at Genoa, planted 37 years ago, branching into several heads, the stem was 30 feet long, 4 yards in circumference at the dilated base, and a foot and a half in diameter some distance above the base. I feel quite satisfied that *canaliculata* and *cornuta* are forms of the same species.

*Y. filamentosa*, L. This is represented at La Mortola by a form which quite agrees with Haworth's *glaucescens*.

*Y. albospica*, Hort. Grown both at La Mortola and Hyères, in fine condition at the latter garden under the name of *Y. elata*. It is the plant described in my monograph under the name of *Y. constricta*.

*Y. Hanburii*, Baker, n. sp. A new species, allied to *albospica* and *fragilifolia*, the seeds of which were sent to La Mortola many years ago by Mr. Sampson Hanbury from the Rocky Mountains. It is acaulescent, with a dense tuft of about 100 very rigid glaucous-green leaves, 1½ feet long, under half an inch broad at the middle, smooth on the face, subscabrous on the back, with a pungent point, and a margin edged with brown with a white streak beyond the brown, from which a very few slender threads split away. It was not in flower at the time of my visit.

*Y. baccata*, Torrey. What is commonly grown as *baccata* on the Riviera is *Y. filifera*, Chabaud, which forms a trunk and inhabits Mexico, whilst the true *baccata* is acaulescent and inhabits California. I saw nothing *in situ* to equal the grand trunk which has just been presented to Kew from his garden at Cannes by M. de Falbe. I saw at Hyères a curious plant called *baccata glauca*, acaulescent, with very glaucous rigid ensiform leaves with very copious stout spreading filæ.

*Y. Whippleii*, Torrey. A fine plant, which has been drawn by Mrs. Thiselton-Dyer, has just flowered and died at La Mortola. I saw another which had lately flowered at Hyères, where it is grown under Lemaire's name of *Yucca californica*. I now think this had better be kept as a genus distinct from *Yucca*, under Engelmann's name *Hesperoyucca*.

### Genus Dasylirion, Zucc.

All along the Riviera Dasylirions are a prominent feature in the gardens, and the soil and climate appear to suit them admirably.

*D. acrotrichum*, Zucc. Grown everywhere and flowers freely. Easily recognised by the leaves breaking into a tuft of threads at the top.

*D. glaucophyllum*, Hook. Like the last, grown all along the Riviera and flowers freely. *Bonapartea gracilis glauca* and *Dasylirion gracile glaucescens* both represent the typical form. *Bonapartea gracilis*, of the Hyères garden, differs by its bright green leaves. It may be a distinct species, but I did not see it in flower. A plant grown at La Mortola as *Dasylirion hybridum* may be the same. What I saw called *D. quadrangulatum* was all *glaucophyllum*. In a plant seen in flower at Genoa the peduncle with the panicle reached a length of 20 feet.

*D. juncifolium*, Hort. Hanbury. This I was very pleased to see in flower in a state of full perfection at Monte Carlo and again at Genoa. It has a great tuft of 200–300 recurving rigid linear leaves, 3–6 feet long, not more than a quarter of an inch broad at the middle, vertically striated, slightly glaucous and convex on both faces, scabrous on the margin, not splitting up into threads at the top. The peduncle is 15–20 feet long, bearing, in its upper half, dense spikes of minute whitish flowers in the axils of great scariose serrated lanceolate white bracts. Mr. Watson sent home specimens in fruit of the same plant two years ago from Hyères. It may be *D. quadrangulatum*, S. Wats., in a state of full development.

### Genus Nolina, Michx.

*N. longifolia*, Hemsley. Grown commonly all along the Riviera under the name of *Dasylirion longifolium*. I saw it in flower at Genoa.

*N. recurvata*, Hemsley. Not unfrequent in the Riviera gardens under the names *Pincenictitia glauca* and *P. tuberculata*. The finest plant I saw was in the garden of the Baroness von Huttner at San Remo, with a trunk 6 feet in circumference at the base.

### Genus Dracæna, L.

The only true Dracæna grown is *D. Draco*. I did not see any old trunks.

### Genus Cordyline, Com.

The universal *Cordyline* of the Riviera gardens is the New Zealand *C. australis*, Hook. fil., with leaves varying greatly in breadth and rigidity. I did not see any trunks taller than those which we have in the temperate house at Kew. All the plants I saw labelled *indivisa* were forms of *australis*. At La Mortola I saw also plants of the Australian *C. stricta*, Endlich.

### Tribe Aloineæ.

The Aloes were not in flower at the time of my visit, with the exception of *A. ciliaris*, Haw., which grows luxuriantly in the open air.

The commoner large caulescent Aloes of the gardens at La Mortola, Mentone, and Monte Carlo were, not, as I expected, the Mediterranean *A. vera*, Linn., but the Cape *A. africana*, *A. supralævis*, and *A. arborescens* and its variety *frutescens*. *A. striata*, Haw. (*A. albocincta*, Haw.), and its variety *A. hanburyana*, Naudin, are also frequent. I saw also at La Mortola *A. purpurascens*, the typical *A. ferox*, *A. Bainesii*, Dyer (young stems only), and *A. plicatilis*. Of the smaller species *A. aristata* is much finer than we get it in England, and this is also the case with *A. heteracantha*, Baker, which is not yet known in flower. A caulescent species, grown at La Mortola, allied to *A. arborescens*, with a dense tuft of lanceolate leaves 7–9 inches long, margined with minute teeth, at the top of a long slender erect stem, is probably new and undescribed. Dr. Penzig has lately introduced from Abyssinia to the gardens at La Mortola and Genoa, *A. abyssinica*, *A. commutata*, and three other species. Mr. Hanbury also grows *A. variegata*, and has some curious varieties of *mitriformis* and *humilis*, which are different from anything I have seen at home. He grows many Apicras, Haworthias, and Gasterias, none of which seemed materially different from what we have at Kew. A *Gasteria*, called *multipunctata*, with glossy lorate leaves 1–1½ feet long, with obscure immersed greenish-white blotches, is probably an undescribed species.

### Order Bromeliaceæ.

The species which are hardy on the Riviera are *Tillandsia xiphioides*, *Puya gigas*, *Hechtia Gheisbreghtii*, *Dyckia brevifolia* (grown under the name of *D. Mazelii*), and *D. rariflora* (grown under the name of *D. remotiflora*).

It is quite evident that the climate and soil of the Riviera are admirably fitted for the growth of a large proportion of these plants. As might be expected, there is a general tendency in the leaves to be more glaucous than at home. A great many species reach their full development on the Riviera which we get at home only in an undeveloped condition. The principal groups of Agaveæ, which are not represented and are but little represented on the Riviera, are the *Aloideæ* and *Viviparæ*, and Furcræas of the *cubensis* group. It is probable that these require more moisture and perhaps more heat than they get in the Riviera climate. My best thanks are due to Mr. Hanbury for his kindness and the trouble which he took to help me in every way; and to his principal gardeners, MM. Cronemeyer and Villa, to whom, during my stay, I was constantly applying for information.

J. G. Baker.

Herbarium, Kew,
December 17, 1891.

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## CCXXIV.—CAPE TOWN BOTANIC GARDEN.

The Cape Town Botanic Garden, which has hitherto been under the charge of Professor MacOwan, F.L.S., as director, is about to be placed under municipal control. The character of the Institution will thereby be changed. It will "no longer be a botanical establishment," according to the *Cape Argus*, "but a town *pleasaunce* of flowers and shady walks." Professor MacOwan's services will be transferred as Government Botanist to the Agricultural Department; and it is intended also

according to the same authority, to remove to the department buildings the Cape Government Herbarium, of which Professor MacOwan is the keeper. These changes are to take effect from the 1st January 1892.

From a strictly scientific point of view these changes can hardly be regarded than those of a retrograde character. The severance of a capable scientific man from the control of the chief Botanical Garden of an important colony like the Cape, is calculated to lower the status of the Institution, and it is inevitable that its scope will be restricted to that of a "town *pleasaunce* of flowers and shady walks." It is inevitable also that it should lose its national character amongst similar institutions in other parts of the world, and its value as a means of solving important problems connected with the development of the vegetable resources of the colony, must be subservient to its functions as a municipal institution.

It is to be hoped, however, that botanical enterprise at the Cape has not so entirely died out that it may not be possible at some future time to establish a Botanical Garden, under scientific control worthy of the colony and of its vast and valuable resources. The Cape Flora is one of the most interesting in the world. A large number of very interesting and highly valuable plants belonging to this Flora are gradually becoming extinct. The opportunity for preserving them for observation and investigation will soon pass away. A National Garden, maintained by Government and under suitable scientific control, affords the most satisfactory means for preserving and studying such plants, and this duty is recognised in every important colony of the Empire. If suitable land, with the necessary climate for a Botanical Garden, could be obtained within easy reach of Cape Town, it is in every way desirable that the idea should not be lost sight of, and that the Government should recognise the duty of providing such a garden as one of the national institutions of the country.

Its economic influence, directly and indirectly, upon the development of the vegetable resources of the colony may be gathered from the results that have accrued to other colonies from similar institutions. These, however, are hardly more important than the scientific value attached to the preservation of the singularly interesting plants of South Africa. Such plants could only be successfully cultivated and preserved in an institution where they could be arranged and grown under circumstances entirely removed from the merely local interest engendered by municipal control.

The following historical account of the Cape Town Botanic Garden is taken from the *Cape Argus*, dated November 18, 1891 :—

The Botanic Garden originated in proposals made to the Government by Dr. James Adamson and a few of his friends interested in horticulture and in botany, especially Dr. Ludwig Pappe, Mr. R. H. Arderne, and Messrs. Kotzé, Clarence, Ross, Fairbairn, and Rutherfoord. Something of the same kind had been proposed long before, and discussed in the public papers, and mainly on the suggestion of James Bowie, a collector of plants sent out by the Royal Garden at Kew. Nothing resulted, however, till Dr. Adamson brought up the matter once more, and kept it before the public and the Government. The Commissioners were appointed May 5th, 1848, and immediately opened a subscription list, appointed as gardener a local nurseryman of the name of Draper, and set to work in earnest to lay out and plant up the area cut off for their use from the Government Gardens. This space then extended from the present line of Wale Street to a sunken roadway, constructed at the

instance of Sir George Grey, across the upper boundary of the garden to the top of what is now New Street. Down the western side from this point ran an irregular sluit, dry and fœtid in summer, a roaring torrent during winter rains. It was to preserve the boundary from being washed out and encroached on that the celebrated wall and its Cyclopean buttresses, which have become historic nuisances, were erected. Beyond this, from a point nearly opposite the Art Gallery, a scrubby hedge marked rather than defended the outline. A rude footway, or plank, spanned the sluit and pointed the way to Keerom Street. Draper laid out the land with some skill, seeing that it was nearly a perfect flat, and took advantage of such large trees and plants as he found existing—relics of the old Dutch gardeners, Oldenburg and Ague. But the early records show that things were done in a very primitive way. Crops of potatoes and forage were grown by Draper and his coloured labourers, and sold on the market to assist the funds subscribed, and the Government grant of 300*l*. per annum, and it was not until late in the year 1848 that the collection of plants was commenced by purchase from the executors of Baron Von Ludwig of some of the stock accumulated by him. For reception of these, a small greenhouse, of quaint and ornamental design, resembling a birdcage, was constructed. It has only recently been removed. This and other expenditure landed the Commissioners in debt. The Cape of Good Hope Bank pressed for a reduction of the over-draft, and the Commissioners began their difficulties with paper to the amount of 250*l*. They also took over the seed stock of Thomas Draper, and thus began the seed-selling business which has continued to the present year. In 1849, Karl Zeyher, the celebrated botanical collector, was added to the staff, to name and label the plants, and go round among the private gardens to obtain seeds and cuttings and to bring in bulbs and plants from the veld. He was also " to prepare a " '*Hortus siccus*' and seed collection, to instruct apprentices in theoretical " and practical botany, and attend to such visitors and strangers as " may require botanical information." This highly scientific and extensive commission was rewarded with the wonderful stipend of 7*l*. 10*s*. per month.

The pecuniary position of the place did not even allow of this small tribute to science, so inadequately was the garden supported by Government. But the garden was from the first supported by Government in a very inadequate manner, and from " Personalia of Botanical Collectors at the Cape, page 21, 8vo., 1887," we find that " The projectors found " themselves obliged in February, 1850, to dismiss Zeyher, whose quali- " fication was botanical knowledge rather than business aptitude, and find " an ordinary gardener who understood how to turn the place into a " nursery and make it pay for itself. Dr. Berthold Seeman, knowing " little of the hard necessity of the case, was perhaps more witty than just, " when he wrote in reference to Zeyher, on his visit in 1851, that the " Committee had just 'passed a resolution that their Botanic Garden " could do without a botanist.' " To Zeyher succeeded James M'Gibbon, an enterprising Scotchman, born at Elgin, and apprenticed in the Duke of Sutherland's garden there. He ultimately married the daughter of Mr. Rennie, the Duke's bailiff A son of Rennie's had enlisted, gained the distinction of the V.C., and received a commission in a regiment proceeding to the Cape. By his influence, a place was found for M'Gibbon as Messenger to the Mixed Commission Court. After service in this capacity he returned to his original occupation at the Botanic Garden, succeeding Zeyher, but as gardener, not as botanist, March 1850. During the long period of his service up to 1881, he carried on the business of the garden with great ability and business tact on a kind of partnership system with the Committee, and accumulated a

handsome competence. Latterly he became crippled with rheumatism, and, returning to England for the benefit of medical advice, he died at Richmond, in Surrey, about 1886.

In 1857 the waste ground between the sunk-road boundary and the present college area was granted to the garden as a set-off against the appropriation of a large piece at the Wale Street end for the building of the library and museum. The cost of putting this acquisition in order, fencing, planting, and maintaining, sorely crippled the finances of the Commissioners. All the assistance given was a grant of 300*l.* from the Treasury and the services of a gang of Kafir prisoners. The gift of the ground was something like that of the historic white elephant—it was costly, and brought nothing in. There was no water supply, and a well put down by the Commissioners gave abundance of water in winter, when it was not needed, and none in the dry season. For many years the only value of the ground has been in its forming a reserve on which to deposit leaves and garden sweepings for rendering down into soil, and giving an annual supply of a few tree seeds. It has been closed to the public since 1885, when the obnoxious sunk road was filled up with soil removed in levelling the site of the Parliament House Gardens, and a new level cross-way made a little higher up. To keep it open and bring it into anything like order, would have absorbed the whole Government annual subsidy, and required separate labour gang and police supervision. It was therefore left severely alone.

Much of the present appearance of the gardens is due to Mr. M'Gibbon's labour. He raised great numbers of Australian shrubs and trees from seeds obtained from Sir Ferd. V. Mueller, and planted them, if anything too thickly in the previously bare grounds of the garden. To his industry and enterprise evidence is given by an extensive list of species under cultivation, published by him in 1858, and by numerous contributions to the local papers upon the seasonal operations of gardening. On his resignation, Professor MacOwan, who had for many years been the friend and correspondent of Harvey and Sonder, was appointed by the Commissioners in 1880, in hope of restoring the garden to a fitting status among botanical establishments. The great herbarium of Zeyher, after remaining in the possession of Dr. Pappe till 1863, had been purchased by the Government, and a portion of it ordinated by Dr. Harvey, about the year 1864. The charge of this collection which had lain *perdu* ever since its return from Harvey's temporary possession was added to the duties of the new director. The radical defect of the institution, however, was an utterly insufficient subsidy of 500*l.* per annum to meet an expenditure of about 1,400*l.* No scientific enthusiasm could supply that balance of 900*l.* It was therefore impossible for any scientific work to be done save out of business hours, and the whole energies of the staff were incessantly directed to the one object of making money enough to pay the wages and repair dilapidations. This has been done during the present régime for the last ten years, and unlike almost any similar institution in the colony, the garden is this day not one penny in debt. The director says it is mainly the head gardener's doing: the head gardener turns the statement the other way, so they are safest left bracketed as men who have, under circumstances of great difficulty and discouragement, worked together manfully in perfect mutual trust, and kept the institution going by sheer dint of industry. Professor MacOwan has for years past insisted that the selling business of the garden must inevitably drain away into the ordinary commercial channels, and that his position was utterly untenable. Any further economy was impossible, when everything had been pared down to the

quick. There was absolutely nothing to be done but to abolish his office, and reconstitute the garden on lower lines. It was no longer to be a botanical establishment, but merely a town *pleasaunce* of flowers and shady walks. The necessities of the Agricultural Department were at the same time drawing largely upon the director's time. The gardens had long been a sort of headquarters, whither came multitudes of queries and complaints on cultural matters. These now poured in from the department until it became obvious that scientific knowledge and experience were very little wanted in the garden and very much wanted outside it. This necessity, fortunately accompanied by a more liberal recognition of the higher municipal functions on the part of the town council, brought the re-constitution of the gardens within the limits of possibility. Of the Commissioners, nominally in charge of the gardens, but few remained, and these were willing to resign the title, if only they were secured from pecuniary loss in winding up their business as seedsmen, and their staff were not turned adrift after a decade of laborious years.

This is just what the new arrangement, which will come into work with the New Year, amounts to. The professional charge of the garden falls to Mr. Henry J. Chalwin, undoubtedly the most experienced horticulturist in the colony, as a department of municipal concern, just as it should have been long ago. The director will have only one more report to make, and that, we venture to say, of a different kind from the nine sharped-edged documents previously issued. He then goes over to the Agricultural Department in Burg Street, as Government botanist or consulent, or adviser, in matters belonging to his special art and mystery. Thither also, we understand, goes the Cape Government Herbarium, if, indeed, it can be got into the limited space available. Ere long, we should say, it is bound to be housed in quarters built expressly for it.

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## CCXXV.—GOLD COAST BOTANICAL STATION.

An account of the establishment of a Botanical Station at Aburi for the Colony of the Gold Coast was given in the *Kew Bulletin* for July 1891, p. 169.

The following further account of this station has been communicated to this establishment by the Secretary of State for the Colonies :—

COLONIAL OFFICE to ROYAL GARDENS, KEW.

SIR, Downing Street, December 22, 1891.

I AM directed by the Secretary of State for the Colonies to transmit to you, for your information, an extract from a despatch from the Acting Governor of the Gold Coast, regarding the Botanical Station at Aburi.

I am, &c.

(Signed) ROBERT G. W. HERBERT.

The Director of the
Royal Gardens, Kew.

EXTRACT from a DESPATCH from Mr. F. M. HODGSON, Colonial Secretary of the Gold Coast, to LORD KNUTSFORD. Dated November 9, 1891. No. 345.

2. The Botanical Station has, I find, been suffering from an unprecedented dearth of rain, the season having been drier since the cessation of the heavy rains in July than for many years past. Mr. Eyre, the Acting Curator, has however, been most energetic, and, besides having cleared and brought under cultivation an additional acre and a half of ground, has evidently worked hard to prevent the plants suffering from the want of rain. The coffee and cocoa plants looked healthy, the former more especially so, the soil being apparently well adopted for coffee cultivation. There is also a large quantity of Arnotta dye plants the seeds of which are now ready for gathering.

3. At present the only demand for plants on the part of the natives is for coffee plants, and there is no doubt whatever that the natives in Akwapuri and Krobo are beginning to plant coffee in earnest as a means of livelihood, a movement which is clearly attributable to the influence of the Botanical Station.

4. In my journey to Krobo, I was particularly struck with the large number of small coffee plantations along both sides of the road, none of which had been there in my previous journey in May 1889; and the Basel missionaries at Odumassi, the capital of Eastern Krobo, where I stayed for one night, told me that the cultivation of coffee by the Krobos was becoming universal. The missionaries have, I may state, every opportunity of acquiring accurate information on the subject, inasmuch as it is their practice to regularly visit the Krobo plantations, going from one to another, for the purpose of preaching the Gospel to the people who at certain periods of the year migrate from the villages to their farms with all their families.

5. An all-round price of sixpence per pound is obtainable in Accra by the natives for their coffee. At present the coffee thus purchased by the merchants is used for re-sale in the colony, but it is doubtful whether, when the supply more than equals the local demand, the merchants will give the same price. The price will then, I think, depend to a great extent upon the preparation of the coffee for sale in the London market, and it may become a question whether the Government should not give some practical instruction to the natives as to the best manner of preparing the bean for export.

6. It is very gratifying to find that the establishment of the Botanical Station should already have had such good practical results in the matter of coffee cultivation.

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17. I took with me in my journey through Akwapuri and Krobo a large quantity of Egyptian cotton seed, some of which I gave to King Kwamin Fori of the former country who stated that he would have it planted in some of his own ground, and the remainder I gave to the District Commissioner to distribute in Krepi, where there are numerous native cotton plantations, and where it will be of more use, as the people of Krobo are turning their attention to coffee, and should not at present in my opinion be drawn away from it to another industry.

## CCXXVI.—CHINESE GINGER.

In the *Kew Bulletin* for January 1891, p. 5, there was discussed in some detail the origin of the preserved ginger received from China. From specimens of living plants received at Kew from Mr. G. M. H. Playfair, Her Majesty's Consul at Swatow, in 1878, it was concluded that the plant yielding Chinese ginger was something different from the ordinary ginger plant (*Zingiber officinale*). The prominence given to the subject in the *Bulletin* has led to further investigation, and the fact would appear now to be established that Chinese ginger, in spite of the superficial difference in the appearance of "the large flat finger-like masses" as compared with West Indian and other commercial ginger, is undoubtedly produced by *Zingiber officinale*. The plants received from Mr. Playfair have been shown to belong to *Alpinia Galanga*, Willd.

It is probable that none of the preserved ginger received in this country is derived from the latter plant. Mr. Playfair evidently took some trouble in the matter, and he forwarded plants given him at Swatow as Chinese ginger. It is clear, however, that in some way a mistake was made in the selection of the plant desired, for which Mr. Playfair himself was only indirectly responsible. The further identification of the Chinese ginger of commerce is carefully discussed in the following papers and correspondence:—

SUPERINTENDENT, BOTANICAL DEPARTMENT, HONG KONG, to ROYAL GARDENS, KEW.

Botanic Gardens, Hong Kong,
April 9, 1891.

SIR,

I WAS much interested in reading the article in the January number of the *Kew Bulletin* on Chinese ginger, but, with all due deference to the workers in the subject, I am afraid that the conclusion arrived at is erroneous. I have not seen anything which to me is evidence that *Alpinia Galanga*, Willd., is a source of Chinese preserved ginger. I have never entertained any doubt that *Zingiber officinale*, Linn., supplied the material solely used in the manufacture of preserved ginger at Canton. It may be that the appearance of the rhizomes is different from ordinary ginger as grown in the West Indies, but I am inclined to ascribe any difference between the two to the result of cultivation, and not to generic or specific distinctions. I believe that Chinese ginger is much more succulent than West Indian ginger, so much that, as I have been informed by a gentleman here who has interested himself for some years in ginger, it is impossible to dry the rhizomes sufficiently to render them fit for export in the usual commercial form, or, if it had been otherwise, dried ginger would have been exported from China long ago. The ginger used for preserving is, I believe, chiefly grown in the rich alluvial lands of the Canton delta, but the same plant when grown in mountainous districts, as I myself have seen, is much smaller, and is capable of being dried for local use, the Chinese ascribing much more valuable properties to it as a drug when grown in such localities.

I feel compelled to dismiss *Alpinia Galanga*, Willd., or any other *Alpinia* altogether from my mind as a source of preserved ginger, and I am inclined to think that Mr. Playfair when, in 1878, he sent to England a case of roots of *Alpinia Galanga*, Willd., as the source of preserved ginger, was deceived by the natives who supplied the plants.

From my somewhat extended experience with Chinese in various parts of the neighbouring empire, as well as in Hong Kong, I know how little reliance is to be placed on information supplied by the ordinary Chinaman in regard to plants. I would not withhold due acknowledgment of the usefulness of the natives in helping us to get at true information, but their aid should only be regarded as collateral; the investigator should himself sift and verify everything of importance. As bearing on this subject, I would draw attention to a passage in Mr. Playfair's letter of April 10th, 1885 (published in the *Bulletin*), where he says "it has been established as incontrovertible by Dr. Hance that the ginger plant never flowers." I have no doubt that our late much lamented friend, Dr. Hance, may have been assured by the natives over and over again that such was the case, but I have seen *Zingiber officinale* flower profusely in the Canton delta fields, as you have evidence of in the herbarium specimens which I sent to Kew a few years ago. I have often been amused by the insistance of Chinese that certain trees and plants never flowered, while not only the botanical character of the subjects alluded to contradicted my informants, but individual trees pointed out by them as never flowering have been known to me to flower regularly.

I have sent, per s.s. "Glaucus," a box containing rhizomes of *Zingiber officinale* and of *Alpinia Galanga*, Willd., the former obtained from a preserving establishment in Hong Kong, and the latter from a plant cultivated in these gardens, which Dr. Trimen sent me from Ceylon, and which was part of a plant that had been supplied to him from Kew from the consignment which had been sent to England from Swatow by Mr. Playfair, as I understand. I am convinced that when you see these specimens you will feel assured that the *Alpinia* rhizomes have not sufficient resemblance to preserved ginger either in appearance or taste to warrant the assumption that they are a source of that article. I showed a piece of the *Alpinia* rhizome to the people in the preserving establishment, and asked if that was the article they preserved; they indignantly protested against such an inference, and said the *Alpinia* was only used as a drug, but not preserved. I should not place too much reliance, as I have said, on the bare affirmation of natives, but we have the evidence of our own eyes to show that the *Alpinia* does not resemble preserved ginger.

So far as I have been able to learn, preserved ginger is made at Canton and Hong Kong only. The Imperial Chinese Customs Returns for last year show that in junks alone the quantity of fresh ginger exported from Canton to Hong Kong was over 6,000 piculs (a picul is 133 lbs.). Preserved ginger is manufactured in Hong Kong to a large extent for export to the United States. "Preserved ginger as " understood by us is not made in Swatow. What is preserved there " is made for native consumption, to be used medicinally or for cooking, " and is exported largely to the Straits Settlements, and never to " Hong Kong. This kind of ginger is called Ng Mai Keung." This, I understand, is an *Alpinia*, but it does not resemble the Canton ginger, and is, I believe, not preserved in syrup. The rhizomes of true ginger, Alpinias and Curcumas are all classed generically by the Chinese under the name Keung. *Alpinia Galanga*, Willd., is Leung Keung; *Zingiber officinale*, Linn., Taiyeuk Keung; and *Curcuma* (turmeric), Wong Keung; and so on with other species. Now, I think that the native name of Keung, and the fact that the preserved ginger under consideration is not made at Swatow—which is 200 miles from Canton—will afford a probable explanation of some apparent mistake made when Mr. Playfair sent home what has been called "Chinese Ginger,"

which mistake, supposing that one has been made, has resulted in the dissemination of what appears to be misleading information.

I have taken the first opportunity I have had since the receipt of No. 49 of the *Bulletin* of furnishing you with this information, which I am sure you will be glad to receive.

I am, &c.
(Signed) CHARLES FORD.

W. T. Thiselton Dyer, Esq., C.M.G., &c.,
Royal Gardens, Kew.

EXTRACT from the ANNUAL REPORT on the BOTANICAL and AFFORESTATION DEPARTMENT (HONG KONG) for the year 1890, by CHARLES FORD, F.L.S., Superintendent.

The conclusion arrived at in the article in the *Kew Bulletin* is that Chinese preserved ginger is not obtained from the ginger plant, *Zingiber officinale*, Linn., but from the rhizomes of *Alpinia Galanga*, Willd. The evidence which has led to this conclusion seems to be that Mr. PLAYFAIR sent from Swatow to Kew a case of plants, alleged to be Chinese ginger and which have turned out to be *Alpinia Galanga*, Willd. This evidence, however, has, I fear, afforded nothing of value, except of a negative nature, towards proving the source of preserved ginger. In my opinion nothing is really needed, as I cannot see anything in the preserved ginger which would lead me to suppose that it is anything except the rhizomes of the ordinary ginger plant, *Zingiber officinale*, Linn., which is cultivated so extensively by the Chinese in the neighbouring provinces. In 1886, when travelling through the delta south of Canton, I saw ginger extensively cultivated and flowering freely in the rich alluvial lands. I obtained complete specimens for the herbarium, and they were without doubt the true ginger plant.

The Chinese ginger is apparently more succulent, and the rhizomes are of a larger size than the West Indian article, but there is no specific distinction in the plant.

I cannot but think that Mr. PLAYFAIR, while endeavouring to render a useful service, was the innocent agent of a wrong conclusion having been arrived at through the natives who supplied him with the plants, which were sent to Kew, having brought in the wrong kind. The natives themselves were also probably innocent of any intention to deceive, a mistake possibly having arisen from the Chinese name of true ginger being a generic name applied to different species, and even to different genera of plants. The rhizomes of true ginger and of *Alpinias* and *Curcumas* are all classed generically by the Chinese under the name "Keung." *Zingiber officinale*, Linn., is "Tai Yuk Keung"; *Alpinia Galanga*, Willd., "Leung Keung"; and *Curcuma* (turmeric), "Wong Keung." It is obvious, when these names are considered (as for brevity the word "Keung" only is often used), how easily a mistake may have occurred when dealing with a native engaged to procure roots. There is also another fact to show that the plants sent from Swatow would not be likely to afford evidence of much value in the investigation of the source of Chinese ginger. This article is not preserved at Swatow (which is 200 miles in a direct line from Canton), and it is not likely that it supplies raw material for preserving in the large establishments of Canton and Hong Kong, as there is no information to show that it is exported to these places. I believe Canton and Hong Kong are the only places where this preserve

is made. It is not generally known that the Hong Kong preserving establishments export largely to the United States. Of fresh ginger, junks alone carried from Canton to Hong Kong over 6,000 piculs (357 tons) last year.

The information on "Chinese ginger" furnished by the *Kew Bulletin* having reached China, and, as I understand, having been accepted, it will be useful to put on record this additional information on the subject, and to stimulate further inquiries by those who may have opportunities of affording authentic information and finally disposing of the question.

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PERCY GROOM, Esq., F.L.S., to ROYAL GARDENS, KEW.

Whampoa, China,
November 19, 1891.

DEAR SIR,

I THOUGHT you would be interested in having an account of some work I have done in relation to the source of Chinese ginger.

I told Gardiner some time ago that I had proved by an anatomical examination that Chinese ginger is not *Alpinia Galanga*, and he may have told you—but I deferred sending information direct to you till I could disprove or corroborate Ford's view that Chinese ginger is derived from *Zingiber officinale*. There is no shadow of a doubt concerning the correctness of his views, and he certainly explains the origin of the error. All the zingiberaceous plants known to the Chinese are termed "Keung," which I should think would preferably be translated by some such word as "Gingerwort." Ordinary ginger is "Tai Yuk Keung" (large flesh ginger); candied ginger is "T'ong Keung" (sugar ginger); dried ginger is "Kon Keung"; Galangal is "Leung Keung" (mild ginger); Curcuma is "Wong Keung" (yellow ginger). In addition I find in the dictionary the following phrases which I cannot personally guarantee: "Shang Keung," raw (edible) ginger; "Tsz Keung," tender shoots of ginger (edible). By officials whom I requested to ascertain all about the varieties of "Keung," I was informed the "Shang Keung" and "Tsz Keung" were the same plant, but were varieties, one being cultivated in a dry and the other in a wet soil. This is a good example of the variety of information one can extract from Chinese and from a dictionary. The dictionary gives "Ko Leung Keung" as the zedoary.

Believe me, &c.
(Signed) PERCY GROOM.

P.S.—Please utilise the information concerning Chinese ginger as you may think fit.

[Enclosure.]

Recently it has been suggested in the *Kew Bulletin* that Chinese ginger is the rhizome of *Alpinia galanga*.

Mr. Ford, in his annual report for the Botanical and Afforestation Department of Hong Kong for 1890, casts doubts on the conclusions thus arrived at.

To decide the question, I first obtained preserved ginger (dry, and in syrup), and I bought the natural ginger from street vendors. The specimens thus procured all agreed in structure, but they differed from *Alpinia Galanga* obtained from Mr. Ford (a cutting of the original plants sent from Swatow).

I then caused inquiries to be made concerning the manufacture of preserved ginger. The manufacturers stated that only one sort of plant-rhizome was employed (Tai Yuk Keung), and no other sort of rhizome was ever mixed with it. In particular they stated that no variety of galangal rhizome (Leung Keung) was ever used in the manufacture of ginger.

Hence so far it was safe to conclude that whatever Chinese ginger might be, it could not be *Alpinia Galanga.*

It remained to test Mr. Ford's view that *Zingiber officinale,* Linn., was the source of Chinese ginger. At the end of October I ordered the head gardener of the College gardens at Whampoa to procure flowering specimens of the plant from which Chinese ginger (Tai Yuk Keung) was obtained. The flowering specimens thus obtained turned out to be a *Zingiber;* and Mr. Ford informs me that they are specimens of *Zingiber officinale,* Linn. I also had fresh ginger purchased in the market by my servants (for at that time of the year the manufacturers of preserved ginger have no fresh ginger). This agreed precisely in structure with the zingiber rhizome; and in both these rhizomes the starch-grains were alike (flattened discoid for the most part) and utterly different from the elongated club-like, almost rod-shaped, grains of *Alpinia Galanga* (Hong Kong specimen). These two rhizomes also agreed in structure with those obtained earlier in the year, viz., the preserved and the natural ginger.

Finally I endeavoured to purchase other sorts of fresh zingiberaceous rhizomes in October and was unable to procure any. In all cases I was informed that the medicinal zingiberaceous rhizomes, and those used in flavouring, &c., came from distant parts, and that only the ginger for preserving grew in the immediate neighbourhood. But without relying on this evidence, except confirmatory, it is safe to conclude that Chinese ginger is the rhizome of *Zingiber officinale,* as shown by anatomical observations, inquiries from the Chinese and observations on the flower. Mr. Ford, in his report, said: "The "Chinese ginger is apparently more succulent, and the rhizomes are of "larger size than the West Indian article, but there is no specific "difference in the plant."

It is well known that zingiberaceous rhizomes vary in structure according to the circumstances under which they are cultivated; for example, in hot-houses, the sclerenchyma in the rhizomes of *Zingiber officinale* and *Hedychium carneum* is replaced by collenchyma, and other changes are visible. Hence I can only suppose that Professor Perceval Wright was unaware of these variations, or did not allow sufficient margin for them, in the histological observations which he surely must have made before allowing himself to say "that the large flat ginger-"like masses sent to this country from China differed from any-"thing that the ordinary ginger plant (*Zingiber officinale*) could "produce."

ROYAL GARDENS, KEW.

# BULLETIN

OF

# MISCELLANEOUS INFORMATION.

No. 62.] FEBRUARY. [1892.

## CCXXVII.—SISAL HEMP.

(*Agave rigida*, Mill.)

A remarkable development of the cultivation of Sisal hemp in the Bahamas has taken place during the last three years. The Governor, Sir Ambrose Shea, K.C.M.G., has enlisted such widespread interest, it might be termed enthusiasm, in the subject, that hemp-growing has become, for the moment, one of the most prominent of the new industries of the tropics. Frequent inquiry has been made at Kew, in regard to the plant yielding the best qualities of Sisal hemp, and information has been sought by official and other bodies to enable them to judge of the suitability of the plant for cultivation in other countries. The position taken by Kew in this matter is a very simple one. The various varieties and forms of *Agave rigida*, Mill, the species from which the several sub-species and varieties yielding Sisal hemp are supposed to have sprung, have been carefully studied, and living specimens have been added to the collections in the Royal Gardens. In this respect, the collections at Kew at the present time are probably as complete as any in the world.

Further than this an effort has been made to furnish from time to time in the *Kew Bulletin* such information as could be obtained respecting the methods of cultivation and the incidental conditions of the industry likely to be of general interest.* The Bahamas are

* The following articles have appeared in the *Kew Bulletin* on Sisal hemp and allied fibres from species of *Agave*:—

1887, March, p. 3, Sisal hemp (*Agave rigida*, var. *sisalana*). 1887, March, p. 10, Keratto fibre (*Agave Morrisii*). 1887, December, p. 5, Mexican fibre or Istle (*Agave heteracantha*). 1889, March, p. 57, Bahamas hemp (*Agave rigida*, var. *sisalana*). 1889, October, p. 254, Bahamas hemp (*Agave rigida*, var. *sisalana*). 1890, March, p. 50, Bombay aloe fibre (*Agave vivipara*). 1890, July, p. 158, Bahamas hemp (*Agave rigida*, var. *sisalana*). 1890, October, p. 220, Mexican fibre or Istle (*Agave heteracantha*). 1890, December, p. 273, fibre production in the Caicos. 1891, May and June, p. 133, Keratto fibre (*Agave Morrisii*). 1891, July, p. 175, Bahamas hemp (*Agave rigida*, var. *sisalana*).

fortunate in possessing a soil and climate very favourable to the production of excellent fibre. They also have the great advantage of possessing, on the spot, immense quantities of plants of the best variety known to yield Sisal hemp. This variety is of rapid growth, and is easily handled. It has no side teeth to obstruct or retard the process of harvesting, and the people generally appear to have supported the action of the Governor to such an extent that the establishment of the industry is now within measurable distance of being accomplished.

The only drawback, so far, is the want of a machine that will enable the planters to extract the fibre in an effective and economical manner. As a last resort there is the somewhat crude and clumsy machine long used in Yucatan, but it is probable that before any lengthened period has elapsed a machine of a more suitable character will be forthcoming.

In the meantime, efforts are being made to establish a fibre industry in Florida, where, more than 50 years ago, plants of Sisal hemp were introduced and partially established by Dr. Perrine. A special Report prepared by Mr. Charles Richards Dodge of the Department of Agriculture at Washington [Fibre Investigations, *Report* No. 3, 1891], has lately been issued on the subject. In this Report an account is given of the distribution of Sisal hemp plants in Florida and the adjoining Keys, and it is recommended to utilise these as the starting point of a regular industry. Mr. Dodge says "what can be done in the Bahamas I have "reason to believe can be accomplished in this country [Florida] . . " . . We have the soil, the climate, and the plants. The combination "of capital and inventive genius with these conditions must work out "the problem, if indeed, the question is not already practically solved." A further account of the efforts made to establish Sisal hemp plantations in Florida is given later.

A small but promising effort is being made to grow fibre at some of the Turks and Caicos Islands, and plants obtained from this source and from Florida have been introduced into most of the West Indian colonies.

A short account has been prepared, mentioning most of the localities where plants of Sisal hemp are now found, and this account will afford useful material for enabling those who may wish to do so to decide as to the wisdom or otherwise of embarking in a fibre industry at the present time. At the close of the article, a statement is given of the average price per ton obtained for Sisal hemp in this country during the last 13 years.

### *Yucatan.*

Information respecting the Sisal hemp industry in Yucatan has already been given in the *Kew Bulletin* for March 1887. Since that time an effort has been made to obtain direct from Yucatan a representative collection of the various Agaves cultivated in that country for fibre purposes.

Through the kind offices of the late Mr. Augustus Baker, Her Majesty's Consul at Vera Cruz, a large plant with a tall stem and flowering panicle was received at Kew in May 1890. The plant was dead on arrival, but it has since been prepared as a museum specimen, and is now deposited in Museum II. The dimensions of this plant are

as follows: length of stem (below the leaves) 4 ft.; circumference of stem 36 in.; number of leaves on stem, 50; length of leaves about 4 ft.; breadth of leaves 3½ in.; length of peduncle 14 ft. The branched panicle was received in an incomplete condition, but the total height of the plant as now existing is about 24 ft. The weight of the whole plant in a green state was probably not less than 2½ to 3 cwt. The leaves have the characteristic black terminal spine, and they are furnished throughout with small black teeth about 1 inch apart. This plant belongs probably to the variety *elongata* (*Agave rigida*, var. *elongata*). It is evident that in Yucatan the plants cultivated for fibre are largely composed of this variety. We learn, for instance, that in harvesting the leaves the Indian who cuts off the leaves is followed by an Indian woman, "who with a knife cuts off the spike or thorn-" tipped end and the thorny side of the leaf ready for the machine." In the case of leaves without teeth such as are borne by plants of the variety *sisalana*, it would be only necessary to cut off the terminal spine. Hence, while the latter variety yields fibre of equal if not better quality than the variety *elongata*, its leaves are more easily handled, and they require less treatment during the process of harvesting.

In addition to the large plant received from Yucatan there were received two lots of small plants. The first of these was received on the 31st May 1890, and represented apparently about five distinct kinds. The greater part consisted of plants of typical *A. rigida*, and a good number of *A. rigida*, var. *sisalana*. The others represented forms not easily determinable in a small state. A set, with the exception of the above, has been retained at Kew, and the plants will be determined later. The others were all distributed to the Botanical Gardens at Singapore, and to the Botanical Stations at Fiji and Antigua. The second lot of small plants from Yucatan arrived at Kew on December 16, 1890. On arrival there were 30 plants dead and 11 alive. The latter were, however, so small and sickly that, weakened by the cold to which they had been exposed, it was impossible to save them. This attempt to introduce a representative collection of Agaves from Yucatan, in spite of a considerable sum paid for expenses, was singularly unfortunate. It may be mentioned, however, that Merida, the head-quarters of the hemp industry in Yucatan, possesses only an unpaid Vice-Consul, who is but partially under the control of Her Majesty's Consul at Vera Cruz. It is due to the latter to state that he endeavoured to the utmost of his power to assist this establishment; and if he had not been so remotely placed the result would have been far more satisfactory.

Very little additional information, not hitherto published, has been received respecting the Sisal Hemp (Henequen) industry in Yucatan. The subject has already been very fully treated in the *Kew Bulletin*, and it is only necessary to add a description (with wood cut) of the method adopted for harvesting the leaves quoted in the *Report* of the Department of Agriculture, p. 25.

"This is done by the Indians, who are almost nude, with a stroke of the knife, or *machete*, at the rate of, for one hand, of 2,000 to 2,500 leaves per day. Following the Indian who cuts off the leaves is an Indian woman, who, with a knife, cuts off the spike or thorn-tipped end and the thorny side of the leaf, ready for the machine. One foreman was understood to say that it costs about 38 cents per 1,000 leaves to cut, prepare, and get the leaves to the cleaning machines. On all the large *haciendas* visited were little railways into the fields, upon which

on cars, drawn by mules or oxen, the henequen was taken to the mill, and the waste was taken away."

A Sisal Hemp Plantation in Yucatan.

As will be seen from the above wood-cut a Sisal hemp plantation should be systematically laid out, and to work it economically it is desirable it should consist of a tolerably large area. It has been insisted in regard to fibre plantations in Florida " that small plantations . . " . . will not pay. A large tract is necessary for the economical pro-" duction of fibre, so that the work of cutting the leaves and shipping the " fibre may be systematically continued for the greater part of the year."

As the weight of the green leaves is so large in proportion to the yield of fibre, their conveyance from distant parts of the plantation to the factory must involve considerable labour and expense. For instance, if every 100 tons of green leaves will yield only about 2½ to 3½ tons of dry marketable fibre, it is evident that an immense quantity of useless pulp has to be conveyed to the factory and disposed of as conveniently as the circumstances will admit.

Fibre estates should therefore be established on moderately level ground where light portable railways could be laid, or on moderately sloping ground converging on a single point where wire ropes could be used for sliding the leaves in portable bundles to the factory. The experience gained on sugar estates in cultivating large areas in the tropics and in conveying heavy perishable material to a central point would appear to be generally applicable also to Sisal hemp estates. As in sugar so in Sisal hemp, the advantage will ultimately rest with such estates as are able to reduce their working expenses to the lowest point and compete successfully with the produce of countries like Yucatan and the Philippines.

The *South American Journal* says that "the bulk of the henequen
"grown in Yucatan is sent to New York, and that the export has grown
"enormously. In 1875 the total value of the export from Yucatan, as
"shown by the Custom House returns, did not exceed 710,124 dols.,
"since which period it began to attract greater attention, and in
"1878 the figure almost doubled. The following shows the export of
"henequen in each year from 1878 to 1889:—

"1878, 1,166,504 dols.; 1879, 1,287,375 dols.; 1880, 7,495,467 dols.;
"1881, 2,284,389 dols.; 1882, 2,672,107 dols.; 1883, 3,311,663 dols.;
"1884, 4,165,020 dols.; 1885, 3,988,791 dols.; 1886, 2,929,116 dols.;
"1887, 3,901,628 dols.; 1888, 5,229,460 dols.; 1889, 6,872,593 dols."

It is mentioned as a curious circumstance that the market price of the fibre in New York increased almost *pari passu* with the increase of exports.

From Messrs. Crocker's American Statistics (quoted in Messrs. Ide and Christie's *Monthly Circular*, dated 15th January 1892) we find that the total importations of Sisal hemp into the United States during the years 1889–1891 were as follows:—1889, 237,736 bales; 1890, 230,800 bales; 1891, 286,700 bales. Of these latter we find 10,006 bales were re-shipped to the United Kingdom. The total importations into the United Kingdom (London and Liverpool), according to Messrs. Ide and Christie, were 20,296 bales. It is evident from this that the English market in regard to Sisal hemp is comparatively small.

As regards Manila hemp the result is very much the same, although in the first instance the bulk of the shipments are received in the United Kingdom. For instance, during the year 1891 there were received in the United Kingdom a total of 448,000 bales of Manila hemp. Of these there were re-shipped to the United States 175,919 bales, leaving 272,081 bales for consumption on this side. The total receipts of Manila hemp in the United States for 1891 (direct and *viâ* Europe) were 316,697 bales.

Taking the combined consumption of Sisal and Manila hemps (known generally as "white hemps"), we find the relative quantities taken on both sides of the Atlantic to be approximately as follows:— United States, 693,391 bales; United Kingdom, 292,377 bales.

## Florida.

It is well known that plants of Sisal hemp were introduced to Florida from Yucatan, by Dr. Perrine in the years 1836 and 1837. It is to this introduction that Florida and the adjoining Keys owe their present supply of this valuable fibre plant. In a recent Report on Fibre Investigations (No. 3, 1891) issued by the United States Department of Agriculture, Mr. Charles R. Dodge gives a detailed account of the distribution of Sisal hemp plants in Florida and he supplies some new and interesting facts respecting their original introduction. In illustration we quote following paragraphs:—

"Mrs. Walker informs me that the first introduction of the plant from Yucatan occurred in the years 1836 and 1837, a few plants having been sent to the Royal Botanical Gardens of Cuba at the same time. Of the plants brought to Florida, part were taken to Indian Key and the others were planted upon "the Indian hunting ground," on the borders of Biscayne Bay. It is also stated that when these plants had multiplied to some extent the officers at Fort Dallas, at the mouth of the Miami

River, 12 miles from this locality, were in the habit of gathering the young ones to send to greenhouses in the north, and also to other posts where they were grown as ornamental plants. One of the results of this practice was to introduce the plant into many new localities in Florida, where it soon obtained a foothold. The plants set out on Indian Key multiplied very fast and a few years after the destruction of the enterprise, and the death of Dr. Perrine at the time of the Indian massacre, a schooner load of the young plants were gathered and taken away, though it is not stated where they went. * * *

"From this first introduction of the *Agave rigida* into Florida the plants spread rapidly, especially on the mainland, being commonly transplanted to the gardens of the early settlers of south Florida, chiefly for the sake of ornament. * * *

"These facts are considered worthy of mention, as showing that while every other evidence of former cultivation has long since disappeared the Sisal hemp, regardless of forest fires, weeds, and neglect, still holds its own and spreads year by year. * * *

"In the remarks of Dr. Engelmann, in Appendix A., the 'Yaxci' form, *Agave ridiga*, var. *sisalana*, is so fully described that there can be no doubt as to the plant that is meant. The late Dr. Parry, at one time botanist of the Department of Agriculture, found it in full bloom in February 1871, at Key West, and on the adjacent islands, and describes the leaves as "pale green but not glaucous, 4 to 6 feet long and 4 to " 6 inches wide, generally smooth-edged, but here and there having a " few unequal, sometimes very stout and sharp teeth." This is the plant introduced into Florida by Dr. Perrine, for fibre culture, and considered by Dr. Engelmann to be "the most valuable of the fibre-producing Agaves."

"This is the form that I found growing along the entire southern coast of Florida, on my recent survey, from Cape Canaveral on the east side, around to Charlotte Harbour on the west or Gulf coast, and including many of the Keys. * * *

"The most interesting tract visited along this portion of the coast was found on the point perhaps a mile below the railroad station and wharf at Jupiter. Here I found a thicket of these Agaves, both the smooth and spined varieties, many of the plants having shot up their "poles" or flower stalks, which were covered with blossoms and young plants. * * * At Juno, about 10 miles farther south, at the head of Lake Worth, I found another fine nursery of perhaps 100,000 plants, the property of Mr. A. M. Fields, who is quite enthusiastic on the subject. Fully 50 per cent. of his plants are not *Agave sisalana*, however, but a species which was subsequently met with at many points along the east and west coast, as well as on the Keys, doubtless *Agave Mexicana*." [This determination requires verification. Ed. K. B.] "At Addison's Landing, near Cutter, I found myself on the Perrine grant, though Mr. Addison informed me that the plants were chiefly growing on his own section. He estimates the number of old plants at about 15,000, growing without cultivation, and states that these have descended from the comparatively few plants which were on the place 25 years ago when he first occupied the land.

"The original planting, he states was done by Mr. Charles Howe who was associated with Dr. Perrine. He has both the spined and the smooth-leaved varieties, but makes the interesting statement that the latter "spreads" much faster than the former. As a matter of fact I found plants of the spined form, at this place exceedingly few and far between. * * * From this point I sailed southward, but found nothing of particular interest until Upper Metecombe Key was reached

where some of the most superb plants observed on the trip were seen. In one thicket, to which it was almost impossible to obtain access save at the expense of torn clothing and lacerated flesh, magnificent plants were seen where the tips of the leaves were two feet above a man's head.

"Indian Key, where Dr. Perrine lost his life, lies just below and beyond it is Lower Metecombe. Other Keys of the group are Lignum Vitæ, Shell Key, and some lesser ones, upon all of which the true Sisal hemp plants are found in abundance. A very rough estimate of the old plants in this group of Keys would be a hundred thousand, though in making the estimate I have relied largely upon the statements of the intelligent Bahamians living upon them. * * * Superb plants were examined by me at Fort Myers on the Caloosahatchie River and at other points, though there were no such thickets as seen on the Keys."

## Bahamas.

The progress made in extending the cultivation of Sisal hemp in the Bahamas has been already duly noticed in the *Kew Bulletin*. In a recent report published by Mr. James M. Rae, and quoted in the *Bulletin* of the Botanical Department, Jamaica, No. 24, October 1891, it is stated that 12 months ago there were 4,199 acres of land in the Bahamas planted with Sisal hemp, and the aggregate number of plants actually put out was over two millions and a half. In addition to this it was estimated that there were over one million and a quarter plants in nursery beds; and from root suckers and bulbils (called pole plants) there would be available during the ensuing six months about two million plants more. According to this estimate the total number of Sisal plants actually existing in the Bahamas at the close of the year 1891, would not be far short of six millions.

The distribution of the various Sisal hemp plantations, and the methods of cultivation pursued in the Bahamas are described in the following extracts :—

"The people of Abaco, Harbour Island, Long Island, Rum Cay, Exuma, and Grand Bahama, where the largest number of Sisal plants are met with, have for many years past, been in the habit of making a small quantity of rope for home use, from the fibre they extracted from the leaf of the Sisal by the primitive method of bruising and maceration.

"In Abaco are the "headquarters" of the Sisal industry; for it is on this island, and some of its adjacent cays that the largest cultivations in the colony exist. Beginning at Hole-in-the-Wall, Mr. J. S. Johnson, * * * has 200 acres planted with 130,000 plants, some of which planted two years ago, have leaves over 3 feet long. Mr. Johnson has also two other cultivations on Abaco, namely, one at East Creek, Little Harbour, of 25 acres, with 21,000 plants, and another at Witch Point of 60 acres, with 31,200 plants. Cotton is being planted between the rows of Sisal.

"The Bahama Fibre Co., Limited, of which Mr. Abbott is the manager, has a field of 150 acres at Broad Creek with 73,000 plants, and another field of 108 acres at Joe Creek, with 62,000 plants. These two fields also contain 264,000 nursery plants. In addition to these the company has purchased a cultivation at Sweeting's Village, and another at Great Guano Cay, both of which were planted some years ago, and are yielding thousands of pole plants (bulbils) as well as a large number of suckers.

" Cherokee Sound has confined itself mostly to nursery planting, and I saw several thousands of such plants growing about this settlement.

" The Munro Fibre Company, managed by Mr. T. Trumble, commenced planting in August 1889, and now have 1,100 acres planted at Cocoa Plum Creek, with 654,000 plants, and 10 acres at Black Sound, with 7,000 plants. In addition to the field plants, there are also about 300,000 plants in nurseries.

" The company intend to plant their fields with cotton between the Sisal, and I understood Mr. Trumble to say that seed for this purpose had already been received from one of the southern States of America. The Company has also a factory at Black Sound, in which there are five of Death & Ellwood's machines worked by a 15 horse-power steam engine. These have been employed in cleaning Sisal leaves purchased from persons who have full-grown plants. The yield of cleaned fibre was ascertained to be about 4 per cent., but I could not help being struck with the large proportion of fibre that was wasted in the process. There can be no doubt that with the improved machinery which the demand must necessarily cause to be produced, the per-centage of cleaned fibre will be largely augmented.

" At Marsh Harbour * * * is the handsomest Sisal field I have seen. This was planted by Mr. Benjamin E. Roberts two years ago, and contains 140 acres, with 107,000 plants. * * * There were at least 25,000 suckers then in the field, and Mr. Roberts assured me that he had already removed 47,000 suckers. This field was being planted with dwarf cotton between the Sisal.

" At Hope Town, Mr. Thomas Russell, * * * has about 20,000 plants, some of which have been growing half a dozen years, and from these he expects to gather 100,000 pole plants (bulbils) this year, in addition to a large number of suckers.

" Another gentleman of the same name, now residing in Nassau, has a very fine nursery at Black Sound, containing many thousands of young plants . . . .

" *Propagation.*—The plant is propagated in two ways, namely, from the young plants furnished by the pole (bulbils), and the suckers which are thrown out from the roots. On the plant reaching maturity, a pole 15 to 20 feet in height grows out from its centre, on which a number of blossoms appear borne on arms which extend laterally from the upper part of the pole. In about six months after the appearance of the pole, bulbils that develop into young plants appear, varying in length from 2 to 4 inches, and in number from 1,000 to 2,500, and occasionally more. They are then gathered and set out 8 or 9 inches apart each way in nursery beds. In six months they will attain a growth of 8 to 12 inches, and they may then be transferred to the field.

" Suckers are plants which grow out from the roots of the parent plant, and in congenial soil are produced in 12 to 18 months. From this time, on to the third or fourth year, they appear in great numbers, many plants producing as many as 20 to 30 suckers during that period; after this they begin to decrease, until they finally cease to appear.

" With respect to the taking up and planting of suckers, I think it well, having regard to the speedy production of new plants, to call attention to a method which I have seen practised with very satisfactory results, viz., in removing a sucker from the parent plant, instead of cutting or breaking off the sucker only, to uproot entirely the white shoot at the end of which it is growing, and cut that off as near the parent trunk as possible. This shoot will be found to be jointed like a sugar cane. After the removal of the sucker, the shoot is cut up into

lengths of two or three joints. These bits are then planted in nursery beds, and in a short time each bit will produce as many suckers as there are joints. This method has the two-fold advantage of speedily increasing the supply of the new stock, and relieving the parent plant of the support of the suckers.

" *Field Planting.*—The system adopted by those who have engaged largely in planting varies. Some have planted as near as 6 feet each way, others, 7 × 7, 7 × 8, 7 × 9, 8 × 8, and 9 × 9. The Munro Company at Abaco, plant three rows 8 feet apart, with 7 feet interval between the plants, and leave a space of 12 feet between every fourth row The Bahama Hemp Company, Limited, under * * * Mr. Abbot, plant four rows 8 × 8, leaving a distance of 12 feet between every fifth row.

" Many planters have planted the spaces between the Sisal plants with some other crop, either ground provisions such as pigeon-peas, corn, &c., or cotton. This plan appears to be attended with excellent results, and is one that I cannot too strongly recommend, provided always that such auxiliary crops be not too thickly planted. The slight shelter they afford seems to be beneficial to the Sisal plants in their early growth, and tends to suppress the growth of weeds, thereby lessening the cost of keeping clean the field, beside yielding a remunerative crop. Sweet potatoes should not be planted in a Sisal field, at least not until the plants have attained a growth of a foot and a half to two feet, as the vines very soon cover the field and completely envelop the young plants, and retard their growth.

" *Effect of different soils and aspect on growth.*—I have both read and heard it broadly asserted that Sisal will grow and flourish anywhere, no matter how sterile or impoverished the land may be. My observations, however, do not confirm this. I do not mean to convey the idea that *really good rich land* is necessary for its successful cultivation, but merely to remove the impression, if such there be, that the plant will thrive in dry arid sand, or on rocky land void of soil. Worn out 'provision' and pine-apple fields appear to be well suited to its cultivation, while on broken, rocky surfaces, containing innumerable 'potholes' and crevices, in which is deposited the ordinary black or red earth, the plant luxuriates.

" *Crop.*—The length of time required for the production of the first cutting of leaves may, I think, safely be regarded as four years from the time of planting. A great deal depends upon the size of the plants when transplanted, but if they be of a suitable size, say from 12 to 15 inches, without doubt the leaves will attain a length of 4 to 5 feet and be fit to cut, well within the period named. I have seen thousands of plants with leaves from 2 to 3 feet long that had been growing only two years; and I have also seen plants, that I was told were three years old, from which leaves had been already cut.

" For the present, the yield per acre with us, can be only a matter of calculation, as the industry has been so recently begun; but sufficient positive experience has been derived to determine this point with approximate accuracy. The number of leaves cut from many plants of four years growth and upwards, has given an average of 40 leaves per plant, with an average weight of 1½ lbs. per leaf, and a yield of 4 per cent. of clean fibre. With an average of 600 plants to the acre, and 40 leaves * * * to each plant, the yield would be 36,000 lbs. of leaf and 1,440 lbs. of cleaned fibre. If the estimate be reduced to 35 leaves, there will be 31,500 lbs. of leaf and 1,260 lbs. of fibre, and this is certainly a very modest estimate. To

guard against all possible disappointment, however, the yield of fibre per acre can be safely placed at half a ton."

Considerable interest has lately been taken in endeavouring to trace the source from which the Bahamas have received their present supply of Sisal hemp plants. The Bahamas Sisal (or Pita, as it is called locally) is identical with that existing in Florida and the adjacent Keys. We have trustworthy evidence that the Yaxci Sisal plant (the variety with pale green and smooth or unarmed leaves, known as *Agave rigida*, var. *sisalana*) was introduced to Florida direct from Yucatan by Dr. Perrine in 1836 and 1837, that is about 55 years ago. Full information on the subject is contained in Senate *Document*, 30, dated Washington, March 12th, 1838; and in the *Report* of the Agricultural Department at Washington for the year 1869. We gather further particulars from Mr. Charles R. Dodge's *Report* on Fibre Investigations, No. 3, 1891, recently issued by the same Department. Mrs. Walker, Dr. Perrine's surviving daughter, states that the general planting of the Perrine grant (in accordance with the conditions imposed by the Government) occurred in 1846. For this purpose 36 families of Bahamas people were to be brought over to Florida "to go upon " the land to fulfil the condition of a settler upon each section. The " men came over to build their houses and plant their gardens prepara- " tory to bringing over their families when they were driven or " frightened away by the Indians and could not be induced to return. " It was about this time that the Agave was planted upon each section." After the death of Dr. Perrine and the practical abandonment of the plantations, the Agave plants spread rapidly and they were transplanted everywhere in gardens by the early settlers for the sake of ornament and possibly also to make hedges. It is also mentioned by Mrs. Walker that a schooner load of young plants was gathered and taken away but it is not stated where they went. The natural inference is that they were taken somewhere to the south, as it was found that they would not grow much further north than the spot originally intended by Dr. Perrine.

In 1871, the late Dr. Parry found the Agaves in Florida, and he describes them as having "pale-green but not glaucous leaves, 4 to 6 feet " long, 4 to 6 inches wide, generally smooth-edged, but here and there " having a few unequal, sometimes very stout and sharp teeth." This description exactly agrees with that of *Agave rigida*, var. *sisalana*, Perrine. The plants were then widely distributed at Key West and the adjacent coast. They have lately (1891) been carefully examined again by Mr. Charles Dodge with the result already given.

As the islands of the Bahamas are adjacent to southern Florida and there was regular intercourse between the two places about the time of the introduction of the *Agave* plants it was only natural to assume that the Agave now so abundant in the Bahamas had been originally introduced from Florida. They had found in the southern islands a warmer and more equable climate and had spread rapidly throughout the Archipelago. This view has, however, been strongly contested by Sir William Robinson, K.C.M.G., formerly Governor of the Bahamas, in the *Agricultural Record* of Trinidad, January 1891, p. 6. According to his Excellency's view, the Sisal hemp plant was introduced to the Bahamas by the late Mr. C. Nesbitt, a former Colonial Secretary, who " forty-five years ago, viz., in 1845, procured from Sisal, Yucatan, a " few hundred plants of this Agave and had them set out at his country " residence three miles from Nassau." Further "Mr. Nesbitt was

"much struck with the vigour of the plants when grown in New "Providence . . . In 1851 he reduced a great number of the "leaves of this plant into fibre and placed samples of them in the "Nassau Museum. At the same time he sent specimens of them to "England and received very favourable replies in regard to their value "from London."

Whether the whole of the Sisal plants now growing in the Bahamas have been derived from those first introduced by Mr. Nesbitt it is now impossible to say. It is evident, however, that this gentleman was fully aware of their economic value and he deserves great credit for the steps he took to bring them into notice.

The date of Mr. Nesbitt's introduction of Sisal plants into the Bahamas is given by Sir William Robinson as 1845. This would be about eight years after their first introduction into Florida by Dr. Perrine and about the time the Bahamians were engaged upon the Perrine grant to establish regular plantations.

This latter fact may or may not have a bearing upon the question. There is, however, another point worthy of consideration, and it is this : the chief variety of *Agave rigida* cultivated for fibre in Yucatan is apparently not the Florida and Bahamas plant, but one with glaucous leaves and armed with teeth. This is the form nearly always described as growing on Sisal plantations in Yucatan, and plants of this are almost invariably brought from Yucatan as the true thing. The plant, with smooth leaves and of a pale-green colour, was specially selected by Dr. Perrine from his personal acquaintance with it, while Consul for many years at Campeachy.

If Mr. Nesbitt also obtained this particular variety for the Bahamas direct from Yucatan without the special knowledge of its occurrence there, possessed by Dr. Perrine, the circumstance is a singular coincidence.

In the meantime, however, we must accept the claims so ably put forth by Sir William Robinson on behalf of Mr. Nesbitt, and trust that further investigation will confirm the fact that these islands owe to a Bahamas man the introduction of a plant which is calculated to produce so great an influence upon their future prosperity.

## Turks and Caicos Islands.

These islands were once included under the Bahamas, to which group they geographically belong. At present they are under the Government of Jamaica.

In the report of a visit made by the Commissioner of Turks Island to Lorimers on Middle or Grand Caicos in July 1889, he states :—

"Shortly after sunrise on the morning of the 10th instant, I started to walk to *Bourbarra* about four miles distant, and on the way there I visited the Pita plantations which have been established by Mr. Alfred Stubbs, of Cockburn Harbour. This gentleman whose grandfather was the last slave-owner on the Caicos, whose house still stands, owns not less than seven to eight thousand acres on this Island (Grand Caicos) alone, and he is by slow degrees bringing portions of this under cultivation in fibre plants. His system has been to lease his land to the 'farmers' (or 'planters' as they call themselves) at the rate of about two dollars per acre per annum under the condition of their planting so many Pita plants each year. As the land they hold gets gradually taken up by the plants the planters move further afield.

"By these means he has succeeded in getting not less than 300 acres planted out, about half of which is now fit for cutting. His plants are placed too close to each other, and have not been kept clean, but they are strong and in good condition and would furnish leaves from 3 to 4 feet long. Some plants that I saw in the village enclosures which had received proper attention were much finer, the leaves being stout and well-coloured and not less than 4½ feet long.

"The fibre plants planted out by Mr. Stubbs are, I believe, the true '*pita*.' (Specimens have since been received at Kew, and they are undoubtedly *Agave rigida*, var. *sisalana*.) They are exactly similar to those found in Florida and the Bahamas. They have but one thorn and that at the end of the leaf. They have all been grown from imported plants. * * *

"The people are most anxious to start fibre cultivation on their own account, but I could not advise them to do so, until I can see my way to ensuring a sale for their leaves, as of course they could not buy machinery for themselves. Although the Government have but little land in that district, fit for provision farms, they have about 2,000 acres fit for Pita most of which is in excellent position for affording water carriage. This land I shall carefully preserve for the Lorimers' people, in case I am able to induce some persons here to form a company and import the necessary machinery."

The further development of a fibre industry at the Caicos Islands is fully described in the *Kew Bulletin*, December 1890, pp. 273–278. It appears that at West Caicos, Pita plants in good condition were found growing in the bush. The manager of a fibre company (lately formed) had land in an advanced state of preparation for planting purposes, and he hoped in October (1890) to set out plants of which upwards of 200,000 were already in hand. At East Caicos (Breezy Point) there were 15,000 to 20,000 acres suitable for Pita cultivation, and some 200 acres have been already cleared.

## Jamaica.

As might be naturally expected, there has been considerable effort made to introduce plants of Sisal hemp for experimental trial in Jamaica. The present Governor of Jamaica, Sir Henry Blake, has taken a deep interest in the matter, and land has been established with fibre plants adjoining the Hope Gardens. The plants, numbering over 20,000, have made good progress, and the Director of the Botanical Department is in a position to supply suckers on a large scale to those anxious to start a fibre industry. There are large tracts of level and accessible lands in the plains of Jamaica suitable for growing Sisal hemp, and if the people had taken note of these circumstances some 8 or 10 years ago, they would have been able to take advantage of the recent high prices for white rope fibres, and have realised some share of the fortunes which have fallen to the people of Yucatan. At the present time the circumstances have greatly altered, and the advice given by Mr. Fawcett in regard to caution being necessary before embarking, at this late hour, upon a Sisal-hemp industry on a large scale is probably correct. In two or three years' time the extensive plantations in the Bahamas will be sending their produce to the market, and this, in conjunction with the expected increased returns from Yucatan, must tend to lower prices, unless something very unexpected occurs to create a greatly increased demand for Sisal hemp.

The steps taken to obtain Sisal hemp plants for Jamaica are detailed in the following extract from the Annual Report of the Botanical Department for the year 1889:—

"*Sisal Hemp.*—There is considerable demand in the island for plants of Sisal hemp. Three years ago I tried to obtain a supply of plants from Yucatan, but the planters there are so anxious to have a monopoly of a trade which brings them large fortunes that only through a special request from the Colonial Secretary to the British Vice-Consul at Progreso was I enabled to secure one dozen plants of the kind under ordinary cultivation (*Agave rigida*, var. *elongata*).

"Another variety (*Agave rigida*, var. *sisalana*), which is without the teeth on the edges of the leaves, has for some years been growing in the Bahamas, where it was probably introduced from Florida. A specimen of the fibre was shown at the Colonial and Indian Exhibition (1886) by his Excellency Sir Henry Blake, then Governor of the Bahamas. From a test that was made in the railway workshop by Mr. L. Mackinnon on this fibre extracted by Kennedy's machine, it appeared that it is at least as valuable as any fibre previously tested, and moreover, the leaves being without spines on the edges, are cheaper to work up. The Government of the Bahamas had forbidden the export of this plant (called "Pita") for a period of three years, but fortunately it has been found possible to get more than 20,000 plants from Turks Island, and a plantation has been formed at Hope Garden. Mr. Stoddart has superintended the planting. It is expected that it will be found possible to import a considerable number of this variety of the plant, and several applications have been received from planters for supplies of suckers. Considering that the price of Sisal hemp has (recently) fallen from 53*l*. per ton to 27*l*., caution should be exercised in the investment of capital in the enterprise. I should hesitate to recommend its cultivation in any soil which is not suitable to it, and at the same time worthless for other cultivation."

A later account of the Sisal hemp plants at Jamaica is given in the *Bulletin* of the Botanical Department for October 1891, p. 15:—

"In order to encourage the planting of Sisal in Jamaica, the Government has imported lately from Florida 25,000 plants of the same variety as grows in the Bahamas. This is in addition to over 51,000 already supplied to planters, and to over 20,000 planted in the Hope Gardens. * * It is thus possible for any one to obtain a few plants for experiment at a very small expense, or in large quantities for laying the foundation of future fibre farms. * * *"

## British Honduras.

As might be expected from the close contiguity of this colony to Yucatan—the two countries being, in fact, only separated from each other by the River Hondo—plants of the henequen, or Sisal hemp, are fairly common in British Honduras. Some experimental plantations have already been established in the northern parts of the colony, in the neighbourhood of Corosal, where the climate very closely resembles that of Yucatan. Quite recently Sir Alfred Moloney, with that enterprising spirit which has always characterised him in dealing with the resources of any colony with which he is officially connected, has forwarded to Kew specimens of leaves of two sorts of henequen, and of the fibre locally prepared from them. The specimens were labelled respectively Yaxci or Henequen verde (green henequen); and

Sacci (Sacqui) or Henequen blanco (white henequen). Both sorts were apparently varieties of *Agave rigida*, and referable to what is known at Kew as *Agave rigida*, var. *elongata*. The fibre prepared from these leaves arrived in a somewhat soiled and damp condition owing to the fact that it had been packed with the green leaves which had fermented in transit. The report made on this fibre by Messrs. Ide and Christie, dated 17th December 1891, is nevertheless of a satisfactory character :—

"We have been favoured with your note of the 15th instant with regard to the specimens of henequen fibre from British Honduras. We do not make much difference, commercially, between the white and green sorts. Both are very good style of fibre, quite of the Sisal hemp character, and they would be readily saleable to-day in London at 20*l*. to 21*l*. per ton. We think it should be possible to prepare them of a better colour, and with this accomplished a somewhat higher price might be obtainable. As we have mentioned in previous communications colour is of importance in all so-called 'white hemps.' Although up to the present only small lots of Bahamas Sisal have come to this market the colour and preparation have, as a rule, been excellent, and producers in British Honduras should likewise give them every attention."

## Trinidad.

The following account of the introduction of Sisal hemp plants to Trinidad is given in the Annual Report of the Superintendent of the Royal Botanic Gardens, Trinidad, for the year 1891, p. 14.

"*Fibres.*—*Agave rigida*, var. *sisalana*.—During the year we obtained from Messrs. Reasoner Bros., of Manatee, Florida, 10,000 bulbils of this plant, and 2,000 from another source. Of this number 7,700 have been distributed to various applicants. The remainder, deducting usual losses, are still at the gardens.

"One thousand plants requisitioned by Tobago, and two thousand sent to the Convict Depôt are included in the above numbers.

"The plants arrived in splendid order in the form of small bulbils, *i.e.*, small plants without roots. They were placed in beds close together for convenience of culture, and as soon as properly rooted were transplanted at a wider distance, where they have thriven remarkably well. This is the plant which (it would appear from all accounts) is now being cultivated so largely in the Bahamas, and from which such 'great expectations' arise."

## Windward Islands.

A good deal of interest has been shown by the Governor-in-Chief, Sir Walter Hely-Hutchinson, in the introduction of plants of Sisal hemp to the Windward Islands.

At the Grenada Botanical Station, the Curator, in a *Bulletin* (No. 9, September 1891), states that "there are in cultivation about 2 acres of Sisal hemp. These were planted out according to Stoddart's method, viz., 12 feet between rows, and 10 feet in the rows on a rocky hillside facing the west, and therefore fully exposed to the sun. For the sake of experiment, to half of this cultivation, light shade has been given by planting a row of corn between the rows of Sisal hemp, and it is worthy of notice that the plants so shaded have made far greater progress than those without shade. It would seem, therefore, that although the Sisal hemp plant may be extremely hardy, and require

no shade in its native habitat or in those islands where it has fairly become naturalized, yet in introducing its cultivation to these islands it is rather an advantage to give the plants slight shade, at any rate, during the first few months of its growth."

In the Report of the Curator of the Botanical Station at St. Vincent, dated the 1st August 1890, it is stated that "two thousand plants of Sisal hemp (presumably *Agave rigida*, var. *sisalana*) have been received from Florida. One hundred and thirty of these were found on arrival to be perfectly useless, and 1,600 were distributed. The remaining 270 were retained for the Botanic Gardens, where the largest plants were placed in the most suitable ground at my disposal, the rest being planted in nursery beds whence later on they will be transplanted."

In connexion with introduction of plants of Sisal hemp to St. Vincent it may be mentioned that in August 1890, Mr. J. H. Hart, F.L.S., Superintendent of the Botanical Gardens, Trinidad, drew attention to the existence of an *Agave* in St. Vincent, in the neighbourhood of Calliaqua, very similar to what may be regarded as the wild state of *Agave rigida*. It was furnished with teeth and it yielded very good fibre. Specimens of this plant are now under cultivation at Kew. It is evidently closely allied to the Sisal hemp plants, but the leaves are short, and seldom exceed 1½ to 2 feet in length. The habit of the plant closely resembles that of *A. excelsa*, Jacobi. On account of the shortness of the leaves, and the occurrence of teeth, this plant is not likely to be in large demand as a fibre plant in any locality where the very long leaved and unarmed *pita* of the Bahamas and Florida (*Agave rigida*, var. *sisalana*) is obtainable. The St. Vincent *Agave* has also been noticed at Barbados, and probably it will be found in others of the West India islands.

In the Report of the Curator of the Botanical Station at St. Lucia for the year 1890, it is stated that "with the view of forward-" ing the establishment of a fibre industry in the island, the Govern-" ment undertook the importation of 5,000 plants of Sisal hemp (*Agave* " *rigida*, var. *sisalana*) from Florida. They arrived in good condition, " and were at once planted in nursery beds to gain strength before the " final planting out. Of these plants about 700 have been already sold, " and orders have been booked for immediate execution; one for 1,000 " plants and the other for 600 plants."

## South Europe.

Various varieties of *Agave rigida* are found in the south of Europe and especially in the gardens of the Riviera. They are grown chiefly as ornamental plants, but large quantities of suckers and bulbils would no doubt be available if they were required for distribution to other countries. These plants have recently been studied on the spot by Mr. J. G. Baker, F.R.S., keeper of the herbarium and library at Kew, and a note upon them was given in the *Kew Bulletin* for January last, p. 4, which is reproduced :—

"*Agave rigida*, Miller. This is the most valuable and most variable of all the Agaves. It is common and quite at home in the Riviera gardens and flowering freely. I had an opportunity of studying its character and range of variation far better than I had ever done before, and of seeing several forms with which I was not previously acquainted. The commonest forms on the Riviera show the characteristic small distant nearly black teeth, and agree very well with what have been described

and figured as *A. Ixtli* and *A. ixtlioides* (Bot. Mag. t. 5893). In Dr. Hern's garden, situated just on the French side of the boundary gorge at St. Louis, I saw a form with leaves much thicker than usual (1½ in. thick at the base) and forming a less dense rosette. The plants called *A. Cantula* and *A. Rumphii* in the Riviera gardens are forms of *A. rigida*. Mr. Hanbury has just flowered a spineless form that agrees very well with the variety *sisalana* of Yucatan and Florida. I am quite satisfied now that *A. Houlletii*, Jacobi, is nothing more than undeveloped *sisalana* and the same holds good with a plant called *A. lævis*. One panicle of this species at La Mortola was producing copious bulbils. The peduncle, including the rhomboid panicle, does not reach a greater height than 12–15 feet. The bract leaves, like those of *Agave americana*, are small and distant as compared with those of *A. atrovirens*."

Mr. Baker expresses the opinion that *Agave lævis*, Todaro (not *brevis* as given in the Handbook of *Amaryllideæ*) a plant of which he found under that name at La Mortola is probably typical *Agave rigida*, var. *sisalana*. A fine photograph of this was recently sent to Kew by Dr. Todaro which is now in the Kew Herbarium. *Agave Candelabrum*, Todaro, may on further acquaintance prove to be *Agave rigida*, var. *elongata*.

## West Africa.

In April 1890 there was received, through the Colonial Office, specimens of leaves of an *Agave* from Sherbro in the colony of Sierra Leone, West Africa, known locally by the rather singular name of Wild Sarsaparilla. The leaves were evidently those of one of the numerous forms of *Agave rigida*. They had small distant black teeth and the terminal spine so characteristic of the species. The leaves were thin and rigid in texture and of a glaucous green colour. It is evident from this that Sisal hemp plants have already been introduced into some parts of West Africa. The local name Wild Sarsaparilla cannot easily be accounted for. The thin long roots of some Aroideæ, somewhat resembling those of Smilax, have been exported from the West Indies as Sarsaparilla; but this is the first time that the name has been associated with any species of Agave. It is possible that introduced plants of *Agave rigida* may be found in other West African colonies if they were specially looked for. Their presence so far is interesting as showing how widely diffused many new world plants have become even in the less accessible parts of the old.

## East Indies.

The species of *Agave* hitherto yielding commercial fibre in the East Indies have proved to be either *A. americana* or *A. vivipara*. Investigations undertaken by Kew during the last three years have shown that the Bombay (Aloe) fibre, of which an account is given in the *Kew Bulletin*, March 1890, pp. 50–54, is prepared from *Agave vivipara*, L. (A. Cantula, Roxb.) This fibre is almost unsaleable at the present time, and is quoted (January 15th, 1892) at 4*s*. to 11*s*. per ton. The stock at Liverpool is given at 5,136 bales. Plants of the species abovementioned, received through the India Office, are now growing in the Kew collections. Manila aloe fibre (to be distinguished from the well-known Manila hemp prepared from *Musa textilis*) is also apparently prepared from *Agave vivipara*. This is quoted (January 15th, 1892)

at 14*s*. to 16*s*. per ton. Specimens of leaves of the plant yielding this fibre were lately received from Mr. Alexander Gollan, Her Majesty's Consul at Manila, and the above determination was confirmed. Fibre from *Agave americana* is prepared for local use both in India and elsewhere in the East Indies. It is probable that *Agave rigida* exists only here and there as garden specimens, and we are not aware of the occurrence of the unarmed Sisal plant *Agave rigida*, var. *sisalana* anywhere in the east. Plants of this have lately been distributed in small quantities from Kew to the Botanical Gardens at Calcutta, Madras, Singapore, Ceylon, and Mauritius.

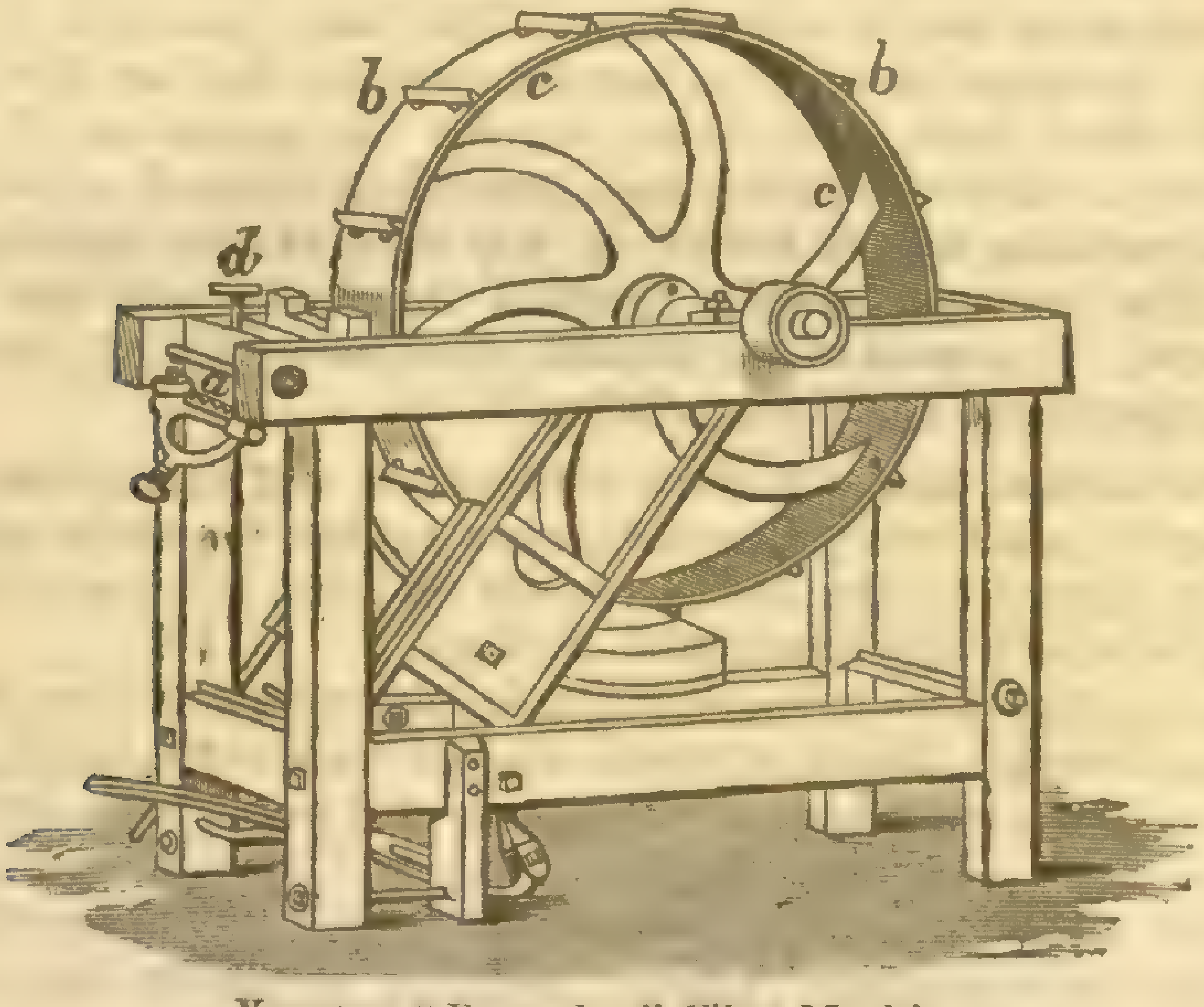
Recently about 1,000 plants were forwarded from Kew to the Botanical Gardens at Calcutta, and the Government of India has since taken steps to obtain a larger quantity for experimental trial in different parts of India.

### Fiji.

At the request of the Governor, Sir John Thurston, who is keenly interested in the development of new industries in this remote British possession, plants of the various species of *Agave* yielding fibre have been forwarded for cultivation at the Botanical Station at Suva. In spite of the long time necessarily occupied in transit by way of Sydney the plants have arrived in good order, and the reports received of their growth is very satisfactory.

### Fibre Machines.

Until very recently the only machine in use in Yucatan was a clumsy affair stated to be a native invention, called a "raspador." Rude as this piece of mechanism is, it is said that a native will clean 20 leaves a minute with it, though with a considerable per-centage of waste of fibre. While the raspador is said to have been superseded on some plantations, it is more or less generally used at the present time for extracting the immense quantities of Sisal hemp exported. The average work of one machine is claimed to be 7,000 leaves per day with two feeders or operatives.




Yucatan "Raspador" Fibre Machine.

The above is a respresentation of one of the Yucatan machines taken from the Report of the Department of Agriculture, U.S.A. [No. 3,

1891]. The following description of it is quoted by Mr. Charles Richards Dodge :—

"It is simply a wheel, like a 4-foot pulley, 6-inch face, with pieces of brass an inch square, and 6 inches long, running across the face about a foot apart. This wheel runs in a heavy wooden case. When working well it makes about 110 revolutions a minute. The leaf is put in through a small hole in the case, and being held by a strong clamp, is allowed to whip downward as the wheel moves around. A heavy block, like the brake of a car-wheel, is, by lever, brought to bear on the leaf, pressing it against the revolving wheel. In a second the pulp is crushed and thrown into a pit under the wheel, and the fibre is drawn back, one half of the leaf being cleaned quicker than one can follow the motions. The leaf is reversed and the other end cleaned in the same manner."

In the Bulletin of the Botanical Department, Jamaica, July 1891, a report is published of the results of experiments with the Weicher fibre machine at Jamaica. The machine was driven by steam power, and it required four persons to feed it and remove the fibre.

Amongst the leaves cleaned were those of the Sisal hemp plants, *Agave rigida*, var. *elongata*, and *Agave rigida*, var. *sisalana*. The results may be briefly summarised as follows: 115 leaves (weighing 185 pounds) were cleaned in 17 minutes. These yielded wet fibre weighing $20\frac{3}{4}$ pounds, and dry fibre weighing $8\frac{1}{4}$ pounds. The out-turn of dry fibre per day of 10 hours would thus be about 291 pounds.

At the Bahamas an American machine known as the Albee Smith fibre-cleaning machine was lately tried. An account given by the United States Consul at Nassau, dated July 10th, 1891, states that :—

"Considerable difficulty was experienced in getting the machine to run properly, owing to the fact that the steam plant used was defective, and the pulley and belts were not of the proper size, width, &c. But, despite these drawbacks, the operation of the machine was said to be decidedly satisfactory, and nearly all present were of opinion that, under proper conditions, the machine would very easily do all that was claimed for it, and that it was a most valuable improvement over all other machines in use in the colony. The new machine is entirely automatic. It grips the leaves continuously as fast as the operators can supply them, holds them firmly during the operation of cleaning, and delivers the fibre completely and beautifully cleaned at the further side. No reversing of the leaves or any part of the machinery is required. The operator simply supplies the leaves, and the machine does the rest. It is said to be capable of cleaning 50,000 leaves a day, extracting therefrom 3,000 lbs. of fibre."

It will be noticed that the exact returns are not here given. Those claimed for the machine by the makers are evidently purely conjectural, and, having regard to the tested results of other fibre machines, it is impossible to attach any importance to them.

Numerous other fibre machines have been brought before the public during recent years. Some of these are of undoubted merit, but it is evident that the expectations of cultivators of Agave plants have not yet been fully met. The conditions existing in Yucatan, where clumsy and wasteful machines have hitherto been adopted with apparent success, are of a peculiar character. Labour there is so cheap that cultivators can afford to carry on the industry under circumstances entirely unsuited to other parts of the world. Numerous improvements have, however, been lately made in English and American machines, and

there are good grounds for believing that the problem will be ultimately solved. The point requiring special attention is to ensure continuous action in feeding the leaves to the machine, and so save the time and trouble of reversing the leaves before the whole length can be cleaned. The automatic feeding attached to some machines whereby the leaves are presented sideways may accomplish this, but so far such an arrangement has not been tested for a sufficient time to judge of its practicability. The urgent demand which will soon be felt in the Bahamas for a satisfactory means of utilising the extensive fibre plantations established in those islands will call forth strenuous efforts on the part of those interested in the subject. At Mauritius a machine for extracting the fibre of *Furcræa gigantea* has been in use for some years, and it appears to give satisfactory results. This is fully described in the *Kew Bulletin*, May 1890, p. 98. The labour in Mauritius is chiefly supplied by Indian coolies.

## Market Value of Sisal Hemp.

In view of the largely increased production of Sisal hemp in Yucatan, and the extensive planting which is taking place in the Bahamas, Turks Islands, Florida, and other places, it may be useful to review the prices which have been realised by Sisal hemp of good quality in this country during the last 10 or 15 years. By the courtesy of Messrs. Ide and Christie, fibre brokers, of 72, Mincing Lane, E.C., we are in a position to place on record the average prices per ton of Sisal hemp in the London and Liverpool markets for every month during the last 13 years from 1879 to 1891, both inclusive. The table attached speaks for itself. It may, however, be useful to point out that the price per ton has been as low as 17*l.* 15*s.* (in January 1886), and in March 1891 it rose as high as 56*l.* 10*s.* These are the minimum and maximum prices respectively during a period of 13 years. The average price for each of the 13 years, beginning with 1879, are as follows:—24*l.*; 27*l.*; 28*l.*; 28*l.*; 27*l.*; 21*l.*; 19*l.*; 21*l.*; 33*l.*; 37*l.*; 50*l.*; 30*l.*; 26*l.* The average price for the whole period is 28*l.* 10*s.* nearly. Prices ruled highest during the year 1889, when the average price was 50*l.* per ton. During the year 1891 the average price was 26*l.* per ton, or nearly one half of what it was two years previously in 1889. The last return issued by Messrs. Ide and Christie, dated the 15th January 1892, quotes Sisal hemp, spot value, at 23*l.* 15*s.* per ton. The market report is, "Sisal has again fluctuated, but closes at the "top, and 2*l.* per ton higher than when we last noticed." It is evident that the market value of Sisal hemp has shown considerable fluctuation of late years.

It has already been shown that the bulk of the Sisal hemp produced in Yucatan is shipped to the United States. The price paid for Sisal hemp in the New York market during the last 13 years is therefore necessary before we can take a complete view of the Sisal hemp industry for that period.

So far, we can only give returns of prices in the United States, published on the 31st December 1891, for the last three years as follows:—

1889, $8\frac{5}{8}$ cents per pound (40*l.* per ton); 1890, 6 cents to $6\frac{1}{4}$ cents (nominal) (28*l.* to 29*l.* per ton); 1891, $4\frac{1}{4}$ cents to $4\frac{3}{8}$ cents (20*l.* to 20*l.* 10*s.* per ton).

In the meantime the complete returns kindly placed at our disposal in regard to Sisal hemp in this country cannot fail to be of service:—

AVERAGE PRICE per TON of fair quality SISAL HEMP in the LONDON and LIVERPOOL MARKETS for 13 years from 1879 to 1891 (inclusive).

| Months. | 1879. | 1880. | 1881. | 1882. | 1883. | 1884. | 1885. | 1886. | 1887. | 1888. | 1889. | 1890. | 1891. |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | £ s. | £ s. | £ s. | £ s. | £ s. | £ s. | £ s. | £ s. | £ s. | £ s. | £ s. | £ s. | £ s. |
| January - - - | 23 0 | 32 10 | 28 0 | 27 10 | 28 0 | 22 10 | 19 0 | 17 15 | 27 10 | 36 0 | 50 0 | 40 10 | 28 10 |
| February - - - | 23 0 | 32 10 | 29 0 | 27 10 | 28 0 | 22 10 | 18 10 | 17 15 | 28 0 | 36 10 | 52 0 | 38 0 | 27 10 |
| March - - - | 22 0 | 29 10 | 27 0 | 26 10 | 28 0 | 23 10 | 18 10 | 18 10 | 28 10 | 37 0 | 56 10 | 32 0 | 28 10 |
| April - - - | 21 0 | 29 10 | 29 0 | 25 0 | 29 0 | 23 0 | 18 10 | 18 5 | 31 0 | 38 0 | 53 10 | 28 0 | 28 0 |
| May - - - | 21 0 | 26 10 | 29 0 | 27 0 | 27 0 | 21 0 | 19 10 | 18 10 | 32 0 | 35 0 | 53 0 | 26 15 | 28 10 |
| June - - - | 22 0 | 23 0 | 29 0 | 28 0 | 26 10 | 21 0 | 19 10 | 18 15 | 30 0 | 32 10 | 49 0 | 26 0 | 28 0 |
| July - - - | 22 0 | 23 0 | 27 10 | 28 0 | 27 0 | 20 0 | 18 10 | 19 15 | 30 0 | 29 0 | 50 0 | 25 0 | 27 0 |
| August - - - | 24 0 | 24 0 | 26 10 | 27 10 | 25 10 | 21 0 | 18 10 | 24 10 | 33 0 | 32 10 | 50 0 | 25 0 | 23 10 |
| September - - | 23 0 | 25 10 | 26 10 | 28 10 | 25 10 | 20 0 | 18 10 | 25 10 | 37 0 | 39 0 | 50 0 | 27 0 | 22 10 |
| October - - - | 25 0 | 25 0 | 27 10 | 30 0 | 25 10 | 19 10 | 18 10 | 24 0 | 40 0 | 39 0 | 50 0 | 26 10 | 22 0 |
| November - - - | 29 0 | 25 0 | 29 10 | 29 0 | 24 5 | 19 10 | 18 10 | 26 0 | 40 0 | 40 0 | 45 0 | 32 10 | 21 0 |
| December - - | 32 10 | 25 10 | 28 10 | 28 10 | 24 0 | 19 10 | 18 5 | 26 0 | 39 0 | 45 0 | 45 0 | 29 10 | 22 0 |
| Average - £ | 24 | 27 | 28 | 28 | 27 | 21 | 19 | 21 | 33 | 37 | 50 | 30 | 26 |

## CCXXVIII.—INSTRUCTION IN HORTICULTURE.

The funds at the disposal of the County Councils for technical education are being in some cases applied to instruction in Horticulture. Kew has been applied to for advice as to how this can be most effectively organised. The following correspondence is published for the information of those interested in the subject.

MONTAGU SHARPE, Esq., Vice-Chairman of the Middlesex County Council, to ROYAL GARDENS, KEW.

*Technical Instruction in Horticulture.*

DEAR SIR, Hanwell, W., December 13, 1891.

A SUB-COMMITTEE of the above council is now considering the best means of giving instruction in horticulture to the inhabitants of Middlesex who may care to avail themselves of it.

I have been requested to ask you to be kind enough to express your views on this matter, which will be of great assistance to the committee.

At present we have no plans before us, but I might say that for the parliamentary divisions of Brentford and Ealing we think (so far as other subjects are concerned) it would be advantageous to hold classes from time to time in each of the towns, the lecturer proceeding from one to another as soon as a course of instruction was finished. With apologies for troubling you.

I am, &c.
(Signed) MONTAGU SHARPE,
Vice-Chairman, Middlesex County Council.

The Director, Royal Gardens, Kew.

ROYAL GARDENS, KEW, to VICE-CHAIRMAN, MIDDLESEX COUNTY COUNCIL.

Royal Gardens, Kew,
SIR, 15th December 1891.

I AM sorry to say that I feel great difficulty in seeing my way with regard to the general problem of technical education, and horticulture seems to me to present peculiar difficulties. The cultivation of plants is an art which can only be acquired by practice, and therefore, it appears to me, cannot be taught in the lecture-room any more than painting or shoe-making. I know of no royal or theoretical road to the acquisition of a competent or even useful knowledge of the gardener's art except by beginning at the bottom and going through every operation, from the most elementary to the most difficult and refined. If an intelligent young man does that, and keeps his eyes open, he may become a successful gardener. But the mere reading of books and attendance on lectures will never, in my judgment, make anyone even a moderately competent gardener.

If you will look at the *Gardeners' Chronicle* for November 28, 1891, you will see a letter of Professor Huxley's which I reprinted. It ex-

presses in a very clear and forcible way with regard to agriculture the same views which, in substance, I entertain with regard to horticulture.

In the Royal Gardens at Kew, from the necessities of our organisation, we are unable to teach young men the rudiments of their profession. Those we expect them to have acquired before they come to us. What they gain at Kew is the opportunity of seeing a larger range of different kinds of cultivation than they can see in any private establishment. Besides this, we give them the use of a fairly-equipped horticultural library, and lectures on various branches of botany, and on such elementary physics and chemistry as more or less directly bear on horticulture. I very much doubt, however, whether these advantages add very much to the capacity of our men as gardeners. That they must gain for themselves by working in the houses under the skilled direction of able foremen. But I do not doubt for a moment that the time and pains our men bestow on self-improvement is of incalculable benefit to them, by stimulating and developing their general intelligence. The youthful years of most human beings is a period of receptivity. Knowledge is acquired often almost mechanically, like the multiplication table, or a colloquial knowledge of a language. When man's estate is approached or reached, the judgment comes into play. Most persons, unless they are congenital idiots, begin more or less to inquire and speculate as to the reasons of things. This prompts to study and inquiry as to the causes which bring about effects. It is this temper which we try to encourage at Kew. A man may know the rudiments of his art, and never be anything better than a journeyman. But if he begins to ask the why and the wherefore, then he is on the high-road to become a first-rate workman. And I know no art which affords a larger scope for the exercise of a lively intelligence than horticulture. A gardener tries to grow a plant, with the habits of which he is unfamiliar. He fails. He then, if he is a good man, begins to reflect. He brings to bear upon its culture the experience gained in treating similar "subjects." He tries different methods, and watches their effect: resting, watering, different kinds of soil, exposure to light, &c. The plant responds, and by seizing upon each indication of improvement which such a method of interrogation educes, the gardener ultimately finds the clue to success. The whole method is essentially scientific without making any profession of being so. If, however, a gardener, abandoning the experimental method, yields to intellectual indolence and is content to subject the plant to such physical conditions as he learns from a book exist in the plant's native country, then it may be pretty confidently predicted that he will be saved all further trouble by killing it.

I am afraid I have treated you to rather a long essay. But this was perhaps necessary to enforce my conclusion that I do not think the county council can do any good by giving lecture-room instruction in the art of horticulture. I have made inquiries, but I cannot find out that there is any class of persons in this neighbourhood that can be profitably reached by such an enterprise.

The labourers in market gardens are hardly likely to be induced to attend; and the scattered gardeners in the district would in all probability be, in all practical matters, better equipped than the lecturer.

In my opinion, the only course the county council can take is to drop the idea of devoting the funds at its disposal to technical and to apply them to secondary education. Lectures on such subjects as elementary physics, chemistry, botany, and vegetable physiology would aim at nothing more than carrying on general education on subjects not taught, or scarcely taught, in the primary schools. They would be

good as far as they go; would do no harm, and if the teachers were moderately competent, would almost certainly do some good.

I should add, that our Kew system, as a school, is to this extent defective, that it makes no provision for high-class instruction in fruit and vegetable cultivation; this, however, can be obtained at the gardens of the Royal Horticultural Society at Chiswick. There is a useful work open to the county council in obtaining facilities for passing young gardeners through Chiswick on much the same lines as obtain at Kew.

(Signed) W. T. Thiselton-Dyer,
Director.

### Montagu Sharpe, Esq., to Royal Gardens, Kew.

Guildhall, Westminster,
17 December 1891.

Dear Sir,

I think it extremely kind of you to have taken so much pains over your reply to me, on the subject of horticulture in connexion with technical education.

I shall lay your letter before my colleagues, so that they may have the benefit of your advice.

All we can do at present is to draw up a report as to the best methods to be employed for giving instruction in some ten subjects which appear to be most suitable to the needs of the inhabitants of Middlesex generally.

The new council will have to determine to what extent it will proceed in the matter, but I feel sure it will give material assistance to science and art schools, which are already giving secondary education, and which includes, I think, some of the subjects you mention, such as elementary physics and chemistry.

The whole question is a most difficult one, and the council is much indebted to you for the valuable information you have been kind enough to give it.

I am, &c.
(Signed) Montagu Sharpe.

The Director,
Royal Gardens, Kew.

### Horticultural Education.

[*Extract from the Gardeners' Chronicle, November* 28, 1891.]

While the subject of technical education in horticulture is occupying so much attention, we are pleased to be able to lay before our readers the views entertained on the subject by so highly competent an authority as the Director of the Royal Gardens, Kew:—

"You ask me to communicate to the pages of the *Gardeners' Chronicle*, something on the subject of horticultural education. This is undoubtedly a compliment, seeing that it obviously involves the not inconsiderable assumption that I know something about it, or, at any rate, have something to say on the subject which may be worth attention.

"I am by no means unwilling to do what I can. But though my own opinions on the matter are tolerably clear, the various aspects in which the question presents itself at the moment are, to tell the truth,

a little mixed. One has got to fix distinctly in one's mind whom, in the first place, one proposes to educate, and with what object. Some of my friends say gardeners; others 'younger sons:' and here I am reminded that the ladies must not be forgotten. Others, again, insist that intending colonists are the people to be taken in hand; some, on the other hand, suggest that the future peasant-proprietor is the person to be looked after with an eye to fruit culture and the *petite culture* generally. Lastly, there are those who would be content to disseminate a general interest in the subject by peripatetic and popular lectures, addressed to any local audience that may be inclined to attend them.

"It will be admitted that we have here a rather large field for discussion, and, unless we settle what particular item we are taking in hand, I have found that we are apt to get rather at cross purposes.

"I had got as far as this in the sorting out of my ideas, when the August number of the *Agricultural Gazette* for New South Wales came into my hands. Here I found a letter from Professor Huxley, on a subject closely analogous, which struck me as altogether admirable. It has made a boomerang-like flight to the Antipodes, and back again. But it is evidently none the worse for the journey, and I do not see why I should not launch it on its travels again:—

In the course of a paper on technical education, before the Easingwold (England) Chamber of Agriculture, on April 10 last, Mr. J. Harrison read the following letter from Professor Huxley, which appears also in the *Agricultural Gazette* of England:—

"I am afraid that my opinion upon the subject of your inquiry is worth very little, my ignorance of practical agriculture being profound. However, there are some general principles which apply to all technical training. The first of these, I think, is that practice is to be learnt only by practice. The farmer must be made by thorough farm work. I believe I might be able to give you a fair account of a bean plant, and of the manner and condition of its growth; but if I were to try and raise a crop of beans, your club would probably laugh consumedly at the result. Nevertheless, I believe that your practical people would be all the better for the scientific knowledge which does not enable me to grow beans. It would keep you from attempting hopeless experiments, and would enable you to take advantage of the innumerable hints which Dame Nature gives to people who live in direct contact with things. And this leads me to the general principle which I think applies to all technical teaching of school boys and school girls, and that is, that they should be led from the observation of the commonest facts to general scientific truths. If I were called upon to frame a course of elementary instruction preparatory to agriculture, I am not sure that I should attempt chemistry, or botany, or physiology as such. It is a method fraught with danger of spending too much time and attention on abstraction and theories, on words and notions, instead of things. The history of a bean, of a grain of wheat, of a turnip, of a sheep, of a pig, or of a cow, properly treated, with the introduction of the elements of chemistry, physiology, and so on, as they come in, would give all the elementary science which is needed for the comprehension of the processes of agriculture in a form easily assimilated by the youthful mind, which loathes anything in the shape of long words and abstract notions, and small blame to it. I am afraid I shall not have helped you very much, but I believe that my suggestions, rough as they are, are in the right direction.

Yours, &c.

(Signed) T. H. Huxley.

Now, with every word of this, I, for my part, cordially agree. It is just what I meant to say, only said a great deal better. I do not propose to employ it as a stalking-horse, but I am glad to use it as a text for some further observations on a future occasion a piece of sound, vigorous common sense.—*W. T. Thiselton-Dyer, Royal Gardens, Kew.*

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## CCXXIX.—BOTANY OF GAMBIA DELIMITATION COMMISSION.

A Report on the Botanical collections made by Dr. Brown Lester, Medical Officer to the Gambia Delimitation Commission, was published in the *Kew Bulletin* for October and November, 1891, p. 268.

By the courtesy of the Secretary of State for the Colonies there has been received at this establishment an extract from the French *Journal Officiel*, dated 28 December 1891, communicated to the Foreign Office by Mr. Edwin H. Egerton, C.B., Her Majesty's *Chargé d'affaires* at Paris. This extract contains the Reports of the French members of the Gambia Delimitation Commission. A translation of the Botanical section of these Reports is reproduced in the *Kew Bulletin* for the purpose of supplementing the notes supplied by Dr. Brown Lester.

The scientific names in brackets have been added at Kew. A few of the plants mentioned under local names have not been identified. For the most part the plants consist of well known West African species with a few introduced plants and cosmopolitan weeds.

The flora of the regions traversed differs also but slightly from that of Senegal, particularly in the north of Gambia. But the general aspect of the vegetation is not the same in the north and in the south. In the north of Gambia (Niom, Rip, &c.), with the exception of a few *Ficus*, Baobabs (*Adansonia digitata*, L.), and Caïl-cedras (*Khaya senegalensis*, Juss.), of considerable height, no great trees are met with, especially in forests. Outside the villages, surrounded by cultivation, there is everywhere a thicket of high grass, often very dense, with trees, nearly all of small dimensions, scattered more or less thinly through it. In the south (Combo, Fogni), great trees abound. Around the Diola villages there are real forests of enormous *fromagers;* elsewhere the forests consist of most varied species, palms, Caïl-cedras (*Khaya senegalensis*, Juss.), Figs (*Ficus*, sp.), Baobabs (*Adansonia digitata*, L.), tied together by tangled lianes, often very strong, one of the commonest of these is the caoutchouc liane (*Landolphia*, sp.). Bamboo woods of often considerable extent cover Combo and the west of Fogni. The principal species which I have remarked are the following :—

Millet (*Pennisetum typhoideum*, Rich.), the staple food of the natives; round the villages there always exist fields of greater or less extent. Rice (*Oryza sativa*, L.) is only cultivated in Combo and Fogni.

Bamboo, very abundant in the south of Gambia, serves many purposes. The stems (sometimes exceeding 33 feet in height) cut into strips and interwoven by the natives (Mandingoes) form the fences of the squares and villages; entire they are made into handles for

many instruments, and also serve for the framework of the roofs of the huts.*

Ronier (*Borassus flabelliformis*, L.) very abundant in Combo, where in many places it forms forests of considerable extent, often very dense. The very hard wood is used for building purposes.

Palmiste (probably *Elæis guineensis*, Jacq.), found more abundantly in the west of Fogni and on both banks of the Gambia as far as McCarthy's Island and beyond; it yields palm-wine, palm-oil, and *Chou-palmiste.*

Cocoa-nut (*Cocos nucifera*, L.) We only met with this at Bathurst; it has probably been introduced there.

Doum Palm (*Hyphæne thebaica*, Mart.), a palm whose stem bifurcates at the base, then at a certain height branches into three. (McCarthy's Island.)

*Calamus scipionum.* The stem of this, stripped of its leaves, furnishes rattan (on the edges of the creeks and in damp lowlands). [The plant referred to is probably a species of *Calamus*, but not *C. scipionum.* This furnishes the Malacca cane of commerce and is a native of Siak.]

The Dwarf palm (*Palmier-nain*) is abundant on river banks, by the side of mangrove swamps.

Castor Oil plant (*Ricinus communis*, L.), is met with nearly everywhere; rarely exceeds 6 to 10 feet in height.

The Manihot root (*Manihot utilissima*, Pohl.), is eaten by the natives and cultivated throughout the Gambia region.

The Silk tree (? *Eriodendron anfractuosum*, D. C.), also grows throughout the Gambia region; in Rip a large number of trees occur in the vicinity of the villages.

The Oleander (? *Nerium Oleander*, L.), does not grow in the brushwood; there are a few plants at Bathurst.

In the thickets and in the fields there occurs a small herbaceous Crucifer from 18 to 24 inches in height; the flowers generally are rose coloured, but sometimes white, and are produced from November to February.

A Mallow, similar to that found in Algeria, grows in the neighbourhood of Cape St. Mary.

L'Oseille de Guinée (*Hibiscus Sabdariffa*, L.), in the neighbourhood of the Djinnack Creek, grows in hedges near the villages (Niom) and in the forests.

Cotton (*Gossypium barbadense*, L.), is in very great abundance near the villages; it attains sometimes 40 inches in height. [The following other species of *Gossypium* occur in tropical Africa:—*G. arboreum*, L., and *G. herbaceum*, L.]

Baobabs (*Adansonia digitata*, L.), of all sizes are seen round the villages and in the brushwood; less abundnant in Fogni.

A few so called Wild Roses are found in the Fogni forests.

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[* The common bamboo of tropical Africa, according to Munro, is *Oxytenanthera abyssinica*, Munro. This has stems 25 to 50 feet in height and 1½ to 3 inches in diameter at the base, the colour is described as *glauco-pruinosus*. The leaves are linear or oblong-lanceolate 6 to 7 inches long and half to one inch wide. It has been noticed in West Africa at Angola, Pungo and Andongo, by Welwitsch; at Accra (Sierra Leone) by Vogel; and at Nupe by Barter. Munro adds that this fine, distinct-looking bamboo seems to have a wide range in Africa extending into both tropics. Barter says that it was the only arboreal grass he had seen (in Baikie's Niger Expedition), and that the stems were used to pole canoes, and the smaller ones as shafts for spears.]

The Néou (*Parinarium macrophyllum*, Sabine), is a tree abundant in Niom, Rip, and Combo; the fruit has a floury sweet mesocarp, and is used as food by the natives.

The Kevert (probably *Chrysobalanus Icaco*, L.) (in many valleys of Fogni). The fruit of this tree is borne in racemes, red-brown when ripe, with a fleshy sugary mesocarp.

The Cad (probably identical with "Cadda" *Cæsalpinia* near *C. coriaria*), the Wolof name for an Acacia with which many plains in Fogni are nearly exclusively covered.

*Cassia fistula*, L., is very common everywhere.

The Dank (? *Zizyphus*, sp.) grows throughout the region; its drupaceous sweetish fruit is eaten by the natives.

The Hire; the very hard wood of this tree could be used for building purposes.

The Néto (probably *Parkia biglobosa*, Benth.) The Mandingoes use the bark of this as a specific for toothache.

The N'gagna (probably *Mucuna pruriens*, D.C.). The pulp of the pod is covered with stiff short hairs, which, on contact with the epidermis, produce a violent itching accompanied by erythema.

The Ground Nut (*Arachis hypogæa*, L.) is cultivated everywhere; it is the most important commercial product of the Gambia, whence every year from 16,000 to 18,000 tons are exported.

Indigo (from *Indigofera tinctoria*, L. and other species), is cultivated everywhere; it also grows in a wild state along the steep river banks of Upper Gambia. It is the only dye known to the negroes.

The Tamarind tree (*Tamarindus indica*, L.) is found at Bathurst and in the plains of the river.

The Acajou à pommes (probably *Anacardium occidentale*, L.) is somewhat rare in the brushwood.

The Banana (*Musa sapientum*, L.) is found round the Mandingoe villages throughout Combo.

The Calabash (? *Cucurbita maxima*, Duch.), gourd (? *Lagenaria vulgaris*, Ser.) and several varieties of cucumbers and other *Cucurbitaceæ* were noticed.

Caïl-cedra (*Khaya senegalensis*, Juss.) throughout the south of Gambia; rarer on the right bank; it often attains considerable dimensions.

Lemon (*Citrus Medica*, var. *Limonum*, Brand.) found at Bathurst and Combo, but is not very common.

The Orange (*Citrus Aurantium*, Riss.) appears to have been imported by the Mandingoes; their villages, especially in Combo and the west of Fogni, are surrounded by orange trees, many of which are very large and bear excellent fruits.

*Datura Stramonium*, throughout the region.

Nightshade (perhaps *Solanum nigrum*, L.) rare in Rip and Niom.

Capsicums (*Capsicum annuum*, L., and *C. frutescens*, L.) are cultivated by the natives and used for food.

A Tomato (probably *Lycopersicum esculentum*, Mill.) with spherical fruits the size of a cherry is grown.

Diakoto, an herbaceous *Solanaceæ*, with a fruit like that of the tomato of Europe, is used for food by the natives.

*Ficus*, a large number of species are met with throughout the region.

Papaw (*Carica Papaya*, L.) Very common in the villages, those of Fogni excepted.

*Fromager* is the tree of the Gambian region which attains the largest dimensions.

Karité (*Butyrospermum Parkii*, Kotschy) met with everywhere, except in central Fogni.

L'Inée (*Strophanthus*, sp.) Very common, particularly in Niom and Rip; the two species, *S. hispidus* and *S. Kombe*, grow in the woods in the shade of the trees, which serve them for support.

Jujubier (probably *Zizyphus jujuba*, Lam.) in Rip and Sabac there is a wild variety; the Wolofs call it Sidem.

A large number of species of Convolvulus (*Ipomœa*, sp.) are found, many of which bear beautiful flowers. In the marshes are white water-lilies, rushes, and arums. In damp spots, mosses, fungi, and herbaceous ferns, &c. Finally the Caoutchouc liane (*Landolphia*, sp.) (in the forests of Fogni, especially towards the south). In Gambia the trade in this is growing more and more important.

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## CCXXX.—BANANA DISEASE IN FIJI.

A short account of the disease affecting banana plants in Fiji was published in the *Kew Bulletin*, December 1890, p. 272. Specimens of stools were received at Kew last year, but the results of an investigation of them were purely negative. Mr. Arthur E. Shipley, F.L.S., to whom they were submitted, was unable to detect anything abnormal in the roots, stems, and leaves. There appeared to be no trace in the specimens, as received in this country, of nematode worms, of insects, or of any fungoid pest. As indicated in the letter addressed by this establishment to the Colonial Office, dated 13th November 1890, Sir Ferdinand Von Mueller, adopting the view that the disease was possibly produced by a nematode worm, recommended, failing success with various insecticides, ploughing the land, leaving it fallow, and alternating some other crop. The ground could then be re-planted with banana "stools" from an unaffected locality.

The view that the disease was caused, in part at least, by nematode worms, is apparently confirmed by an investigation with fresh material undertaken by Mr. N. A. Cobb, at Sydney, New South Wales. The results are published in the *Agricultural Gazette* of New South Wales, October 1831, p. 622. The Fiji plants were found to be affected with aphides, which, however, could not be proved to have done much damage. In the root-stock a fungus was found, and the fact that this does some damage has been established. The presence was shown by a brown discolouration of the interior of the root-stock and roots.

"It is rather remarkable" (the report continues) "that in the soil about the roots of these plants, nearly 30 species of nematodes should be found, about 25 of which are new species. Two of these species have been shown to be injurious to the plants, one of them attacking the roots, and being found living parasitically on certain brown, rotten cavities, and the other being found between the sheathes of the leaves of the plant, and in some cases even at the very core, where the tissues appeared to be quite sound and white. It will therefore be seen that there are four separate causes for the diseases of these plants, viz., aphides or plant lice, a fungus causing rot in the root-stock, and two different species of nematodes.

"The remedies that are suggested in the present state of our knowledge, which, of course, is incomplete, are these :—

"i. That where the bananas are cultivated, a system of rotation should be adopted; that no attempt should be made to grow banana plants on the same ground continuously for a long series of years * * *

"ii. Judging from the specimens sent, the soil about the banana plants is infested to an extraordinary degree with nematodes, therefore, it is best, in cultivating, to plough deeply, or to occasionally subsoil the land. These nematodes attack the roots of plants, and exist largely within eight inches of the surface. As they become rarer as the depth of the soil increases, it follows that if the land be ploughed deep and thoroughly so as to turn the soil exactly bottom side up, a soil comparatively free from nematodes will be brought to the surface, and, at the same time, the nematodes which were near the surface are buried so deep that they can do much less damage than they could if left at the surface.

"iii. * * * The main difficulty in dealing with these plants is thought to be due to the attacks of the fungus mentioned above, and here the best remedy to recommend is great care in setting the new suckers, *i.e.*, in making new plantations. As pointed out, the presence of the fungus is indicated by discolouration in the root-stock. Now, when suckers are cut off from the old plant with a spade, they should be inspected, and all brown and rotten portions should be carefully removed, and all suckers from which these brown and discoloured portions cannot be removed without destroying the chances of growing, should be discarded."

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## CCXXXI.—MISCELLANEOUS NOTES.

From Mons. E. André, Kew has received in exchange a set of his South American Bromeliaceæ, numbering about 70 species. This is an important addition to the Herbarium, already fairly rich in a family commonly neglected by collectors on account of the difficulty in drying and the bulky nature of specimens.

The Rev. R. Baron, well known for the very large additions he has made to our knowledge of the flora of Madagascar, has forwarded a further collection of dried plants, consisting of 700 numbers. This collection is from a district previously unexplored by English collectors, namely the tropical region north of Antananarivo; and it doubtless contains a large number of novelties, new at least to the Kew Herbarium. The specimens are all that could be desired.

Flora of the "Barren Grounds," North Canada.—Mr. Warburton Pike, who has made a journey to the country north of the Great Slave Lake, in the Great Fish River region, between the lake and Franklin Bay to the north-east, has presented a small collection of dried plants brought thence by him. The common plants include *Vaccinium uliginosum*, *Cassiope tetragona*, *Andromeda polifolia*, *Phyllodoce taxifolia*, *Ledum palustre*, *Loiseleuria procumbens*, *Rhododendron lapponicum*, and *Kalmia glauca*.

Index Kewensis nominum omnium generum et specierum plantarum phanerogamarum, 1735–1885. The printing by the Clarendon Press of this work, prepared at Kew by Mr. Daydon Jackson and

GARDEN.

assistants, under the superintendence of Sir Joseph Hooker, has been commenced, and will now be pushed on with all possible speed. It will greatly facilitate botanical work of every kind. Mr. Jackson has been engaged upon its preparation for upwards of 10 years, and the cost of it is derived from funds provided by the late Charles Darwin, F.R.S., and his family.

St. Helena appears to be unfortunate in the way of pests affecting cultivated plants. A short time ago specimens were received at Kew of the Cushion Scale Insect (*Icerya Purchasi*), one of the most deadly plant-parasites known. This was fully described in *Kew Bulletin*, 1889, p. 191 (with plate). The insect had apparently only lately been introduced to St. Helena, and it is hoped that the steps recommended to be taken will be successful in eradicating it.

A plant which has established itself in some places in St. Helena, and become a troublesome weed, is *Nothoscordum borbonicum*, Kunth. This is closely allied to the Alliums or Garlicks, and although a native of temperate and tropical America, has spread in many places in the old world. At St. Helena, the Governor states that " it spreads with " startling rapidity, and exterminates the grass and other vegetation. " The ground on being turned up presents a solid mass of bulbs to a " depth of six inches. It has been found impossible to separate the " bulbs by hand, as they range from the size of a pin's head to that of " a walnut. An experiment has been made of removing the earth to " the depth of the bulbs, and burning the whole, but this mode of " treatment is too costly." Again, mowing the plant has been found to be of no use.

A closely allied plant, *Nothoscordum striatum*, Kunth, a native of the Northern United States, has been found to be troublesome in the herbaceous beds at Kew. It is almost impossible to eradicate it, and from this experience it is easy to realise the difficulty found in dealing with a similar pest in a tropical country. One method that has been suggested, as so many others have failed, is to soak the ground, after the surface has been slightly loosened, with a liquid "weed-killer." This, however, is a very drastic method, and it cannot be done on a large scale, as it involves considerable expense, besides the abandonment of the ground for a year or two owing to the sterilising effect of the liquid.

A similar pest in tropical countries is the Nut-grass, *Cyperus rotundus*, L. This takes possession of some of the best soils in gardens, and becomes a most troublesome and persistent weed. In some cases by systematic weeding and giving constant attention, it has been found possible to keep the plant in check for a time. If, however, the smallest portion of the roots or tubers are left in the ground the plant soon reappears. It always looks green, and by means of the wide ramifications of its rhizomes, it appears to withstand the severest droughts. The occurrence of this plant as a troublesome weed in gardens, is noticed in reports from nearly every part of the eastern and western tropics, from the south of Europe, the Cape, and Australasia. A simple and effective means for getting rid of such pests, without recourse to expensive or drastic measures, would be of immense value to the tropical cultivator.

His Excellency Sir John Bates Thurston, K.C.M.G., Governor of the Fiji Islands, kindly forwarded to Kew in 1891 a quantity of tubers of *Tacca pinnatifida*, Forst. This is a perennial herbaceous plant, with a tuberous root, yielding South-sea Arrowroot. The flowers are greenish or brown in an umbel on the top of a leafless scape surrounded by an involucre of single bracts. The leaf-stalks are plaited into head-dresses. As a source of arrowroot the plant is of great value. The tubers when fresh resemble new potatoes, and contain a great deal of starch. Tacca arrowroot is preferable to any other in cases of dysentery and diarrhœa. A portion of the tubers received at Kew was distributed to each of the Botanical Institutions at Jamaica, Trinidad, and Lagos, West Africa, in order to establish so useful a plant in these parts of the world. Those retained for Kew have now flowered (January 1891), and a figure, with description, is in course of being prepared for the *Botanical Magazine.*

The demands received at Kew for seeds, plants, and cuttings of choice fruits for cultivation in the tropics show that considerable interest is being taken in selecting the best sorts and in cultivating them in a careful and systematic manner. The assistance rendered by Kew in this respect is necessarily confined to the smaller institutions, such as the newly-created Botanical Stations which have not as yet completed their organisation for regular exchanges with kindred institutions in other parts of the world. During the last two years large supplies of cuttings of selected grape vines and figs, seeds of dates and strawberries, and suckers of pine-apples and of bananas have been distributed to the Botanical Gardens in West Africa, Fiji, and the West Indies. Cuttings of grape vines and figs were obtained by the courtesy of the Council from the gardens of the Royal Horticultural Society at Chiswick. Others were obtained from the establishment of Messrs. Rivers and Son, at Sawbridgworth, Herts.

A review of the number of visitors at the Royal Gardens during recent years will prove of interest. The actual numbers for the five years, 1887–91, inclusive, are as follows :—

| Year. | Sundays. | Week Days. | Total. |
|---|---|---|---|
| 1887 - - - - | 489,483 | 657,220 | 1,146,703 |
| 1888 - - - - | 587,385 | 613,417 | 1,200,802 |
| 1889 - - - - | 659,800 | 826,256 | 1,486,056 |
| 1890 - - - - | 879,118 | 960,848 | 1,839,966 |
| 1891 - - - - | 697,200 | 676,553 | 1,373,753 |
| Total - - | 3,312,986 | 3,734,294 | 7,047,280 |

It will be noticed that the number of people who visit Kew yearly has now assumed considerable proportions. Taking the number recorded for the year 1890, which is the largest yet attained, the annual attendance of visitors is not far short of two millions. There was a falling off for

the year 1891, but this is clearly traceable to the generally wet and cold character of last summer.

The Royal Gardens at Kew were first opened to the public "for healthful recreation and instruction," soon after the appointment of Sir William Hooker as Director in 1841. This was only on week days. They were opened on Sundays from 2 to 6 p.m. in 1854. From 1878 the whole establishment has been open to the public from 10 a.m. on bank holidays.

The gradual increase in the attendance for each decennial period during the last 50 years, 1841–1891, inclusive, may be gathered from following record:—

| Year. | Attendance. | Year. | Attendance. |
|---|---|---|---|
| 1841 - - - | 9,174 | 1871 - - - | 577,084 |
| 1851 - - - | 327,900 | 1881 - - - | 836,676 |
| 1861 - - - | 480,070 | 1891 - - - | 1,373,753 |

If the figures for 1890 were adopted instead of those for 1891, the increase in the preceding 10 years would be almost exactly a million.

The highest week-day attendance yet recorded was on May 26, 1890 (a bank holiday), when the number of visitors reached 106,808. The highest Sunday attendance yet recorded was on the 30th August 1891, when the number of visitors reached 52,545.

Hooker's "*Icones Plantarum*" is devoted to the illustration of new plants of special botanic or economic interest. It was established by the late Sir William Hooker; and the first volume was published in 1837. The sale has never met the cost of production, and it was only through the substantial aid of the late George Bentham, F.R.S., that it was continued at irregular intervals until his death. One volume is now issued yearly at the cost of the Bentham Trustees; and the price has been fixed at four shillings each part, or sixteen shillings a volume. It is edited, under the authority of the Director of the Royal Gardens, by Professor D. Oliver, late Keeper of the Herbarium; and the plants figured are selected from the collections constantly being received from various parts of the world. The first volume of the fourth series, or twenty-first of the whole work, is now complete. Each volume contains 100 plates, so that the total has reached 2,100. In order to place the work within the reach of every botanist the Bentham Trustees have decided to offer the ten volumes forming the third series at 5*l*. the set. Persons desirous of possessing the work should apply to Messrs. Dulau and Co., 37 Soho Square, London, W.

ROYAL GARDENS, KEW.

# BULLETIN

OF

# MISCELLANEOUS INFORMATION.

No. 63.] MARCH. [1892.

## CCXXXII.—THE SPANISH BROOM AS A FIBRE PLANT.

(*Spartium junceum*, L.)

The well-known Spanish Broom of gardens, *Spartium junceum*, L. (Genista juncea, *Lam.*), is a native of the south of Europe, and it is found wild in Spain, Portugal, the south of France, Italy, and Greece. It is a hardy shrub, 5 to 8 ft. in height, with upright round branches of a deep green colour. It has a few lance-shaped leaves, which soon fall off. The flowers are large but not numerous. They are disposed in terminal racemes, and are of a deep yellow colour and sweet scented. Loudon, *Arboretum et Fruticetum Britannicum* (ed. 1838), p. 576, gives a full account of this plant and its cultivation in this country. "In Britain," he says, "the plant is solely regarded as an ornamental "shrub, having the appearance of an evergreen from its smooth, dark "green shoots and fastigiate form, even in winter, when without leaves." It is figured in the *Botanical Magazine*, pl. 85; and in Sibthorp's *Flora Græca*, pl. 671. As the generic name implies (*sparton*, cordage), the plant is known to yield a fibre. It has long been regarded as the material of cordage, nets, bags, and even of sails, which were in use by the Greeks, Romans, and Carthaginians. Owing to the more abundant and cheaper materials prepared from cotton and hemp, the use of the Spanish Broom as a fibre plant has in recent times become confined to remote parts of France and Italy, and even there the industry is gradually becoming extinct.

The plant thrives in the most sterile soils and in localities where few other kinds of vegetation are able to survive. It will grow equally well either in poor sandy soils or in those of a rocky and arid character. The young shoots are used as a winter fodder for sheep and goats. The flowers contain a large amount of honey and are attractive to bees. They also yield a dye. In France the plant is known as *Genêt d'Espagne*. An allied plant, the common English Broom, *Cytisus scoparius*, Link. (Spartium scoparium, *L.*), known as *Genêt à balais* or *le grand*

*Genêt*, is also occasionally used in France for fibre purposes, but its value in this respect is small compared with that of the Spanish Broom. In regard to the latter, Loudon discusses its economic uses as follows:—

"In Italy and the south of France a very good cloth is manufactured from the fibres of this plant, *Spartium junceum.* The shoots are cut over in the course of the month of August, and, after having been made up into little bundles, are dried in the sun. These are afterwards beaten with a mallet, and then steeped in water for three or four hours; after this they are steeped in a ditch, among water and mud, for eight or nine days, and then taken out and washed, which operation has the effect of separating the parenchyma from the fibres. The bundles are then opened, and thinly spread out to dry, after which they are combed in the manner of flax; and the better part is laid aside for being spun, and woven into sheets, table linen, or shirts; the remaining part being used for sacking or for stuffing mattresses. In various parts of France, Italy, or Spain, where neither hemp nor flax is grown, owing to the poverty of the soil, *Spartium junceum* is found an excellent substitute. In Italy, about Monte Cassiano, advantage is taken of a hot spring, by alternately immersing the shoots in it, and drying them in the sun, instead of the more tedious process of immersing them in cold water: when thus treated the parenchyma is rendered fit for separation, and the fibres for combing, in three or four days. The process is said by Rosier to be also performed with the *Cytisus scoparius*; though, according to Desfontaines, this is doubtful. In Languedoc sheep and goats are fed with the branches of *Spartium junceum* during winter, not because it is an excellent fodder, but because there is a general deficiency of forage at that season. Both in Spain and France, the shoots are used for forming baskets, and for tying up vines and other fruit trees. The bees are said to be very fond of the flowers, and the seeds are eaten with great avidity by poultry, partridges, &c. Medicinally, the flowers and leaves, in infusion, act as an emetic, or, in a larger quantity, as an aperient."

In the *Paper Makers' Monthly Journal*, 1883, p. 414, it is stated that genista fibre "is stronger than hemp and has the advantage "that ropes made therefrom acquire greater strength when exposed to "moisture . . . Besides the fibre, the refuse or woody part can be "used for making cellulose that is adapted, owing to its strong texture, "for the manufacture of strong paper." An inventor in the United States (quoted above) recommends the following treatment for extracting genista fibre:—

"The plants are, preferably in small bunches, placed in a tank or vessel filled with water, which is raised to a boiling heat. To this water is added, either before or during the boiling, lye in proportion of about 30 to 60 pounds to 800 pounds of the plants. The lye may be added to the water as such, already prepared, or caustic alkaline earths, in combination with carbonates of alkalies, may be employed, which form the lye in the water containing the plants. Carbonate of lime and carbonate of soda, in proportion of about 30 to 40 pounds of lime and 8 to 12 pounds of soda for 800 pounds of plants, are preferably employed. In the lye the plants are boiled for about five or six hours, after which they are left to cool, and are then removed from the tank or boiler. The plants are then ready to undergo the same treatment as flax and hemp, viz., that they may be steeped, dried, broken, and combed, to be subsequently employed for spinning, weaving, making cordage, yarn,

and for other purposes to be used in place of hemp, flax, jute, or similar plants."

In a recent number of the *Revue des Sciences Naturelles Appliquées* (5 April 1891) a short notice appeared respecting the use of the fibre of Spanish Broom amongst the peasants in the neighbourhood of Lodéve, and in the remote hamlets in the mountains of Languedoc. The following correspondence shows that the industry at the present day is greatly reduced in some places, whilst in others it has become quite extinct.

The efforts made by Kew to obtain specimens of articles made from the Spanish Broom for the Museums of Economic Botany are also detailed.

ROYAL GARDENS, KEW, to FOREIGN OFFICE.

SIR, Royal Gardens, Kew, 24 April 1891.

I AM desired by Mr. Thiselton-Dyer to enclose, for the information of the Secretary of State, an extract from the *Revue des Sciences Naturelles Appliquées*, April 1891, p. 555, on the subject of a fibre obtained from *Spartium* (Genista) *junceum*, L.

2. This fibre, although said to be used on the continent, is not so far represented in our collections in the Museums of Economic Botany at Kew. Mr. Thiselton-Dyer would therefore esteem it a favour, if the assistance of Her Majesty's Ambassador at Paris is sought to obtain specimens of the fibre, and of articles made from it, for the use of this establishment.

3. I am to add, that any reasonable expenses incurred in procuring the specimens will be defrayed by this establishment in usual course.

I am, &c.
(Signed) D. MORRIS.

Sir Villiers Lister, K.C.M.G.,
Foreign Office, S.W.

The SECRETARY OF EMBASSY, Paris, to FOREIGN OFFICE.

MY LORD, Paris, July 16th, 1891.

IN receipt of your Lordship's despatch, No. 81, of the 28th of April last, asking me to endeavour to procure for the Kew Gardens, specimens of the fibre of the *Genista juncea*, and of articles manufactured from it, I addressed myself to the President of the Société d'Acclimatation, to obtain the same. He answered me that he was sorry to say that the Society did not possess specimens of the fibre and products woven from it; but he had written to a correspondent to obtain them, and hoped shortly to be able to send them. This he has not yet done, although his letter was dated the 5th of May. . . . . .

I have, &c.
(Signed) E. H. EGERTON,
for the Ambassador.

The Marquis of Salisbury, K.G.,
&c. &c. &c.

The SECRETARY OF EMBASSY, Paris, to FOREIGN OFFICE.

MY LORD, Paris, August 8, 1891.

WITH reference to the Earl of Lytton's despatch, No. 295, of the 16th ultimo. and to your Lordship's, No. 81, of the 28th of April, transmitting the expression of the wish of the Director of the Royal Gardens

at Kew to be furnished with products from the *Genista juncea*, I have the honour to enclose herewith copy of a letter from the "Muséum d'Histoire Naturelle," to Monsieur Tisserand, of the Ministry of Agriculture, to whom I had applied for information.

This letter says that the textile said to be derived from this "genista" is unknown in the competent departments, and that there has probably been a confusion on this subject in the publication of the Société d'Acclimatation. It might be well, the latter adds, to submit to experiment the rind of the *Genista juncea*, though this rind does not appear to possess the elements of strong or abundant textile fibre.

I have, &c.
(Signed) EDW. H. EGERTON.

The Marquis of Salisbury, K.G.,
&c. &c. &c.

## ROYAL GARDENS, KEW, to FOREIGN OFFICE.

SIR, Royal Gardens, Kew, August 12, 1891.

I HAVE the honour to acknowledge the receipt of your letter of August 10, transmitting a despatch from Paris (herewith returned) relative to a fibre stated to be extracted in France from *Genista juncea*.

2. The matter is not perhaps of first rate importance. But it is the business of this establishment to study local industries based on the use of vegetable materials, as sooner or later they are sure to be the subject of public inquiry.

3. M. Cornu, in his letter, speaks of the information published by the Société Nationale d'Acclimatation de France as being an old affair (il y a déjà longtemps). But, as a matter of fact, it is contained in the number of their *Revue* for April of the present year.

4. The statements are extremely specific or I would not have ventured to trouble the Foreign Office in the matter. Thus it is stated:—"Dans "les villages pauvres du Bas-Languedoc, il est peu de maisons où l'on "ne trouve du linge fabriqué en toile de Genêt." Again:—"Dans les "Cevennes, où le commerce de ce textile se trouve localisé, on "l'emploie également pour faire des cordes, &c."

5. M. Cornu suggests that there is a confusion with *Crotalaria*, the Sunn Hemp of India. This, if really the case, would be very curious.

6. Unless the information issued by the Société d'Acclimatation is purely imaginary, which, as it is a society of standing and repute is improbable, there is a local industry in France of which nothing is authentically known. Perhaps Her Majesty's Consul at Marseilles could find out what the nature of it really is.

7. In any case I must beg to express my thanks for the trouble that has been taken in the matter.

I am, &c.
(Signed) W. T. THISELTON-DYER.

Sir T. Villiers Lister, K.C.M.G.,
Foreign Office, S.W.

## FOREIGN OFFICE to ROYAL GARDENS, KEW.

SIR, Foreign Office, January 28, 1892.

I AM directed by the Secretary of State for Foreign Affairs to transmit to you, to be laid before the Director of the Royal Gardens, a

despatch from Her Majesty's Minister in Paris sending specimens of fibres of the *Genista juncea* referred to in the letter from this office of July 17 last.

I am, &c.
(Signed) T. V. Lister.

The Assistant Director,
Royal Gardens, Kew.

[Enclosure.]

The Secretary of Embassy, Paris, to Foreign Office.

My Lord, Paris, January 27, 1892.

With reference to your Lordship's despatch of this Series, Number 81 of the 28th of April, and to my despatch, Number 295, of the 16th of July last, I have the honour to transmit herewith specimens of the fibre of the *Genista juncea*, L., and of articles manufactured therefrom as requested by Mr. Thiselton-Dyer.

These specimens have just been forwarded to me by Monsieur Geoffroy St. Hilaire, President of the Société Nationale d'Acclimatation de France, who informs me that he has had some difficulty in obtaining the specimens, their place of manufacture being limited to a few remote villages in the Cevennes.

I have, &c.
(Signed) Edw. H. Egerton.

The Marquis of Salisbury, K.G.,
&c. &c. &c.

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Her Majesty's Consul, Marseilles, to Foreign Office.

My Lord, Marseilles, January 27, 1892.

Referring to the Foreign Office despatch, No. 1, Commercial, of the 17th of last August, and its enclosures, which I return herewith, I have the honour to inform your Lordship that, through the kindness of M. Durand, Professor of the School of Agriculture at Montpellier, I have at length obtained and forwarded to the Foreign Office by the Peninsular and Oriental Company's steamer "Chusan" a parcel containing specimens of the *Genista juncea*, and of the articles made from it.

The plant, called locally *Génet d'Espagne*, grows naturally in the country, and it is only utilised for textile purposes at Lodève in the department of the Hérault, where the stuff is only made to order, and the industry, such as it is, is dying out.

I have, &c.
(Signed) Charles G. G. Perceval,
Consul.

The Most Hon.
The Marquis of Salisbury, K.G.,
&c. &c. &c.

The specimens mentioned in the above correspondence received at Kew afford ample material for arriving at a definite conclusion with regard to the origin and character of "Genista fibre." There is now in the Kew Museums a complete set, consisting of twigs, fibre in various stages of preparation, as well as yarns and coarse cloths. These were received from Mr. Consul Perceval. Besides, there is a

sample of coarse sheeting received from M. Geoffroy St. Hilaire, through the British Embassy at Paris. These fully illustrate the fibre industry connected with *Spartium* (Genista) *junceum.* A summary of the information obtained by the *Société Nationale d'Acclimatation de France* whilst engaged in meeting the wishes of this establishment, at the request of Her Majesty's Ambassador at Paris, is given in the *Revue des Sciences Naturelles Appliquées*, February 1892, p. 128.

It is somewhat singular to observe that the first efforts of the Society to secure specimens met with entirely negative results. Their correspondent at Nimes, supposed to be one of the localities where the industry was still carried on, reported that not only did a Genista fibre industry not exist in that district, but he had never heard of such an industry. The plant itself was plentiful enough, and was used for feeding sheep along with needles of *Pinus sylvestris.* The Society for a moment began to doubt, as shown in the correspondence, whether after all Genista fibre was not a myth. The first satisfactory intimation was received from Professor Durand, of the School of Agriculture at Montpellier. This gentleman was ultimately successful, obtaining the specimens received at Kew through the exertions of Mr. Consul Perceval. M. Vilbouchevitch has seen recently in the neighbourhood of Lodéve very fine specimens of yarn, and cloth made from the fibre. Some of the latter had been in use for 15 years, and it was of fine texture and beautifully bleached. An application to the mayor of Lodéve elicited the fact that the industry had existed in his neighbourhood, but at the present time it was almost extinct. He forwarded, however, to the Society a series of specimens consisting of coarse cloth, mattress coverings, and sheeting; the specimens of the two latter were 80 years old. Of very recent manufacture he was able to send only some yarn.

It is evident that this interesting rural industry is fast dying out in France. It may be said to exist now only in very remote hamlets in the Cevennes. The inquiries made by Kew were therefore only just in time to secure the last specimens of cloth made in a laborious fashion before the days of rapid communication and the introduction of cheap cotton and other goods.

As an appendix to the article in the *Revue* above mentioned there is reprinted a memoir by M. Broussonet, entitled "Observations sur la culture et les usages économiques du Genêt d'Espagne," published in 1785. This gives a very interesting account of the industry as it existed in France more than a hundred years ago. In those days, in certain country districts, no other linen material was used except that obtained from the *Genêt d'Espagne.* The soil was too poor to grow cotton, flax, or hemp, and each household made its own cloth as it was wanted. It was never for sale in any quantity. A further memoir is reprinted relating to the use of *Cytisus scoparius*, Link., as a fibre plant. This was known as *Genêt à balais* or *grand Genêt.* The latter memoir was written by M. Yvard in 1787.

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## CCXXXIII.—BARK CLOTH OF UGANDA.

One of the most interesting of recent additions to the Museums of Economic Botany at Kew has recently been received from Sir John Kirk, G.C.M.G. It consists of a large sheet of bark cloth prepared by the

natives of Uganda from the inner bark of a species of *Brachystegia*, a small genus of trees belonging to the *Cæsalpinieæ* sub-order of the natural order *Leguminosæ*. The specimen is about 14 feet 6 inches long, 7 feet broad, and $\frac{1}{16}$ of an inch in thickness, and is of a reddish-brown colour, somewhat lighter on the under side, and is slightly crimped, probably the result of having been beaten out with grooved clubs.

The genus *Brachystegia* is confined to tropical Africa, and seems to be generally used by the natives as a source of bark cloth. Messrs. Speke and Grant in their expedition to the sources of the Nile, 1860–1863, made some interesting notes on the preparation and uses of cloth from this source, which it may be well to add. They say of *Brachystegia spicæformis*, Benth., that it is a light graceful tree of 20 to 40 feet high, common in rich forest, and is known in the Robeho mountains, Zanzibar, under the name of "M'chenga" or "M'nenga," the bark of which is made into kilts, cloths, band-boxes, huge grain stores, matches, roofing for camp huts, &c.; they also add that a blood-red juice exudes on cutting the bark. These same explorers collected slight herbarium material at Keegwah in lat. 5° 5′ S. of what is so far determined as *Brachystegia tamarindoides*, Welw. var.? With the following note—"Native name 'Mecombo,' a first-class tree, as it has "so many uses. Tree 50 feet high, long naked trunk 9 feet in cir-"cumference. Foliage deep green. The wood is considered good "for building. Its bark after being boiled and prepared is made into "white sheets or cloths worn by the natives at 10° S. They also "make canoes, boxes, matches, and ropes from it. Its honey is con-"sidered very superior in flavour and whiteness. First met with "30 miles from the sea; afterwards in the interior it was frequent. "It is so plentiful at 6° S. lat. that our temporary huts were roofed "with its bark, and my plants were protected by planks of its bark, "which answered admirably, being light and stiff."

During Livingstone's Zambesi expedition in 1860 Sir John Kirk collected specimens of *Brachystegia appendiculata*, Benth., a tree of 20 to 40 feet high in the highlands of the Batoka country, where it is known under the name of "Motondo" (Setoka), the seeds being eaten by the natives; he also collected the same species near Muata Manja, 14° 19′ S. lat., and states that the fibrous bark is made into cloth by being beaten out. According to Dr. Meller this tree is known as "Chenga" near Zomba. The herbarium contains a specimen of *Brachystegia longifolia*, Benth., collected by Mr. J. Buchanan in the Shire highlands, and bears the following label—"Njombo. Bark cloth tree, wood very soft." Another herbarium specimen collected by Sir John Kirk near Kusuma, on the river Shire is labelled *Brachystegia, sp. nov.* and is described as being a good-sized tree with a fibrous bark which is used for cloth.

Since the above was written a report has been received through Sir John Kirk from Captain Lugard, the officer now commanding the Imperial British East Africa Company's troops in Uganda, in which the following reference is made to the bark cloth so extensively in use there of which the specimen now in the Kew Museum is an example.

Captain Lugard says, "The fig class [*Ficus*] is largely represented in Uganda "where they are cultivated for the sake of their bark from which "the native cloth is made." Thus, although there can be no doubt that the bark cloth used in Nyassaland and much of that used elsewhere, is derived from various species of *Brachystegia* the subject requires

further investigation, and it is most desirable that those in a position to investigate the question on the spot should send the leaf *at least* of the tree which they have seen used to yield the bark cloth with specimens of the cloth itself.

The seeds of what has been determined as a species of *Brachystegia* from Mashonaland and Manica have recently been received at Kew from the Agricultural Department of Cape Colony.

SECRETARY FOR AGRICULTURE, CAPE TOWN, to ROYAL GARDENS, KEW.

SIR, Cape Town, January 15, 1892.

I BEG to send you herewith some seed of a tree which is found over a large tract of country in Mashonaland and Manica. The person who brought the seed from there calls the tree by the name of "Mahogany," and describes it as a very beautiful one, and one of the most useful trees for South Africa, instancing the employment of the bark by the natives for making strong rope, bags (fit for grain), mats, beehives, &c. He states that the tree grows in every kind of soil and situation, in lowlands and on mountain tops.

I append a Memorandum by Professor MacOwan, until lately Director of the Botanic Gardens here, and should be glad to learn from you, upon identification of the seed, its precise classification.

I have, &c.

The Director, (Signed) W. J. J. WARNEFORD,
Royal Gardens, Kew. For Secretary for Agriculture.

[Enclosure.]

Mr. MacOwan says:—"It is a pity that an English name has been manufactured for this Mashonaland tree. The native name would have some sense and value as part of the history of the species.

"The Transvaal Boers call *Afzelia cuanzensis*, Welw., by the name of 'Mahogoni boom' (boom is Dutch for tree). But it is utterly different from this, its seed being ovoid, black, and each seated in a cup-shaped scarlet arillus. These seeds are often brought down as curiosities.

"I should rather expect this seed to be some species of *Bauhinia*, if a guess must be made. The packet might be sent to Kew, and a few tried here and at Durban."

## CCXXXIV.—ROYAL SOCIETY OF NEW SOUTH WALES.

In publishing the following correspondence the Director of the Royal Gardens feels that he is only putting on record a mark of appreciation as handsome as it is spontaneous, on the part of one of the most distinguished of the Colonies of the Crown, of the usefulness of the official work which the Kew establishment could alone accomplish with the continuous and loyal assistance of every member of its staff.

THE SECRETARY OF THE ROYAL SOCIETY OF NEW SOUTH WALES to ROYAL GARDENS, KEW.

The Society's House, Sydney,
December 23, 1891.

DEAR SIR,

WITH this, under separate cover, I have the pleasure to forward to you the Clarke Memorial Medal, which has been awarded to you by the Council of this Society, in recognition of your distinguished services in the cause of botanical science, and especially on account of your labours in connexion with the development and organisation of the Botanical Departments for the Colonies and India, at the Royal Gardens, Kew.

The Council fully appreciates the beneficial effects which this Colony (in common with the other British possessions) has already derived and will continue to derive from the foresight and scientific zeal you have displayed in the building up of the Colonial Departments of your institution; the Council is also aware of the assistance which the Department under your direction has given to institutions in Sydney, and is not unmindful of the fact that the first collections obtained for the Sydney Technological Museum were received from the Museum of the Royal Gardens, Kew.

The Council trusts that you will therefore accept the medal, as a token on the part of this Society, of the appreciation in which your work is held in Australia.

I am, &c.
(Signed) W. H. WARREN,
Hon. Secretary.

W. T. Thiselton-Dyer, Esq., C.M.G., F.R.S., &c.,
Director,
Royal Gardens, Kew.

DIRECTOR OF THE ROYAL GARDENS, KEW, to ROYAL SOCIETY OF NEW SOUTH WALES.

DEAR SIR, Royal Gardens, Kew, February 8, 1892.

IT was with mingled surprise and pleasure that I received your very kind letter of December 23, informing me that the Council of the Royal Society of New South Wales had done me the very signal honour of conferring upon me the Clarke Memorial Medal (which came safely into my hands at the same time).

I cannot but feel, however, that this distinction is one which has been earned rather by the institution over which I have the honour to preside than by any merit of my own. That, however, rather enhances than diminishes the satisfaction which I derive from it. The connexion between Kew and the Australian Colonies has always been peculiarly close; and I observe that this is no less than the third occasion upon which it has been recognised by your Society. That connexion began in the last century with Sir Joseph Banks, who, though not actually connected in any official way with Kew, was virtually its Scientific Director. It was resumed by the splendid work on the elucidation of the Australian Flora of my immediate predecessor in office, Sir Joseph Hooker, and it culminated in the preparation at Kew by Mr. Bentham of his classical description of the whole Australian Flora. It is, I feel, no small distinction to be associated in the eye of Australian scientific men with these two eminent recipients of the Clarke medal.

My own work has, I feel, been the much humbler one of continuing a tradition which, by the wisdom of the Government, has made Kew as much an imperial as a local institution. The services to which you allude have become so much a matter of routine that they scarcely seem to possess any exceptional merit. Their reward, if they deserve any, continually manifests itself in the kindness and sympathy which Kew never fails to receive at the hands of its Colonial correspondents. If anything is needed to lighten the continuous and perhaps sometimes onerous labours of the Kew staff, it is the feeling that they are working not merely for a limited section of the home community, but for the welfare and gratification of intelligent persons in every part of the Empire.

Kew has undoubtedly in the last half-century been successful in effecting much for the advancement of many material interests. Its highest work has, however, perhaps been accomplished in the encouragement and help which it has been able to afford to the cultivation of science in England beyond the seas. In Australia, with its splendid universities, energetic scientific societies, and fine Botanic Gardens, it sees an offshoot of the best home intellectual life which must always command its warmest sympathy.

I am, &c.
(Signed) W. T. Thiselton-Dyer,
Director.

W. H. Warren, Esq.,
Honorary Secretary,
Royal Society of New South Wales.

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## CCXXXV.—OIL PALM FIBRE.

(*Elæis guineensis*, Jacq.)

The African oil palm is probably the most valuable of the indigenous plants of West Africa. From the pericarp of the fruits the well-known palm oil is prepared, while from the kernel of the nuts another kind of oil is extracted, scarcely less extensively used. According to Sir Alfred Moloney (*Forestry of West Africa*, p. 57), "although the palm oil " industry has existed since 1790, if not before, the valuable palm kernels " on the Gold Coast did not attract attention until 1842 or 1843, when also " the ground-nut industry, at least in the Gambia, had its birth." The palm oil received in this country during the year 1885 amounted to 872,342 cwts., of the value of 1,172,862*l*. The palm kernels received during the same period amounted to 34,507 tons, of the value of 406,856*l*. We have therefore two important products from the African oil palm, the value of the quantity reaching the United Kingdom amounting to about one million and a half sterling yearly. To these we have now to add a third industry connected with the production of fibre from the leaves. It may, however, be mentioned that the immediate prospects of this new industry are not very hopeful. The fibre is extracted

in a laborious manner by the natives, and it is not, as yet, produced in commercial quantities.

Its extensive use locally for fishing lines and other purposes requiring great strength shows that it is one of the most valuable and lasting of tropical fibres. Very little, if anything, has hitherto been published respecting this fibre. Kew is indebted for the first specimens received for the Museums of Economic Botany to Mr. George Arbuthnot Moore, Managing Director of the Palma Trading Company, Liverpool. These were received in June 1891. Since that time a very complete series of specimens illustrating the method of extracting the fibre with samples of twine and fishing lines have been received from the Government of Lagos. A small specimen was received from Mr. Scott-Elliot from Sierra Leone, January 1892.

MESSRS. IDE AND CHRISTIE to ROYAL GARDENS, KEW.

72, Mark Lane, London, E.C.,
June 23, 1891.

DEAR SIR,

WE have your favour of yesterday's date with specimen of fibre said to be prepared from the pinnæ of leaves of the African oil palm *Elæis guineensis.*

This fibre has been known to us for the last 15 years at least, but only from small samples such as you send us. It has never been received in merchantable quantity, to our knowledge, and hence no practical experiments have ever been made with it. Some spinners to whom it was shown, when the first specimens came to hand, stated their opinion that it was too hard and gritty to spin readily, but we are inclined to think this view might have been modified had they had the opportunity of testing it practically. It has great strength and fineness, and if really spinnable we would value it at 50*l.* to 60*l.* per ton to-day in London.

We should be pleased to learn there is a prospect of this fibre being prepared and sent home in quantity, so that its actual value might be ascertained, the small samples, mere handfuls, hitherto received having, as we have said, afforded no means of arriving at this.

We desire to thank you for sending us also some fresh pinnæ of *Elæis guineensis*, and it will afford the writer much pleasure if his examination of them should lead to his arriving at any further opinion of the fibre worth communicating to you.

Yours faithfully,
(Signed) IDE AND CHRISTIE.

D. Morris, Esq., M.A., F.L.S.,
&c. &c. &c.
Royal Gardens, Kew.

ROYAL GARDENS, KEW, to COLONIAL OFFICE.

Royal Gardens, Kew,
September 4, 1891.

SIR,

* * * * *

6. Another subject on which information might be obtained from the Government of Lagos is the extraction of fibre from the leaves of

the oil palm. A specimen of fibre, said to have been obtained from the flat blades or pinnæ of the leaves of the oil palm was lately presented to the Museums of Economic Botany at Kew by Mr. G. A. Moore, of the Palma Trading Co., Liverpool. This fibre was of good quality, and was described by Messrs. Ide and Christie as worth from 50*l.* to 60*l.* per ton. No previous specimens of this fibre existed in the Kew Museums, and hitherto it has only reached this country in small and inconsiderable quantities. It is very desirable to obtain as much information as possible respecting the method adopted by the natives for the extraction of the fibre and the special purposes to which it is locally applied. It would also be desirable to obtain leaves in different stages of preparation, a good quantity of the raw fibre, and any articles such as cords, fishing lines, nets, or cloth made from the fibre, for the use of this establishment.

I have, &c.
(Signed) D. Morris,
Assistant Director.

The Hon. R. H. Meade, C.B.,
Colonial Office,
S.W.

Messrs. Ide and Christie to Royal Gardens, Kew.

72, Mark Lane, E.C.,
January 21, 1892.

Dear Sir,

We are to-day favoured with the specimens of fibre and cord from the leaf of the oil palm (*Elæis guineensis*), for which accept our thanks.

We should be glad to know if your correspondents at Lagos lead you to suppose that this material is, or could be, produced in merchantable quantity for export to this country. As we informed you in a previous letter (23rd June last) nothing but small samples have ever been seen here, and until a quantity of, say, 5 to 10 tons come home, no true estimate of the value can be arrived at.

Permit us to point out that the fibre should be sent untwisted and unplaited.

We fear the per-centage of fibre in the pinnæ is small, and that the extraction must be attended with considerable difficulty.

We are, &c.
(Signed) Ide and Christie.

D. Morris, Esq., M.A., F.L.S.,
&c. &c. &c.,
Royal Gardens, Kew.

In reply to the request for information respecting the methods pursued in extracting fibre from the leaves of the oil palm, a report was received through the Colonial Office from the Government of Lagos. It was prepared by Mr. Alvan Millson, the Assistant Colonial Secretary, and contains much interesting information on the subject. The fibre is extracted from the young leaves only. The process is identical with that used by natives in many parts of the world, and notably, as mentioned by Mr. Millson, by the Caribs of St. Vincent, and of the mainland of tropical America. Some Caribs who were attached to the St. Vincent's Court, at the Jamaica Exhibition, 1891, illustrated the process at the request of the Assistant Director of Kew, during his late

visit to Jamaica. There were several excellent specimens of similar palm fibre shown amongst the St. Vincent exhibits.

NOTES on the preparation of fibre from the pinnæ of the Oil Palm (*Elæis guineensis*).

The inner side of the leaflets of the oil palm contains a fibre almost as fine and tenacious as human hair. This fibre is called Awshawn by the Yorubas, Poaiñ by the Kroos, and N'K'aw by the Accras. It is used all along the coast of the Gulf of Guinea for making fishing lines. Its use is very similar to that of the Supa or Gri-gri palm (*Astrocaryum*) fibre with which the Caribs of the island of St. Vincent and the reef-fringed Honduras coast make their deep sea lines.

In the preparation of this fibre a considerable amount of skill is shown.

The pinnæ of the young leaves which have not been hardened by exposure are the only ones that can be made use of. If too old, the fibre cannot be separated from the tissue, and if gathered before the leaves have opened it has not sufficient strength to stand the rough handling which it has to undergo while in process of manufacture. If gathered at the right age the stripping of the fibre offers no difficulties although the process is both tedious and wasteful.

The mid-rib of the leaflet to be worked is separated with the thumb nail for about six inches of its length as shown in the accompanying series of specimens (Specimen A.).*

The pinna is then laid flat on the left hand with the smooth face upwards, as shown in Specimen B. and in the following sketch.

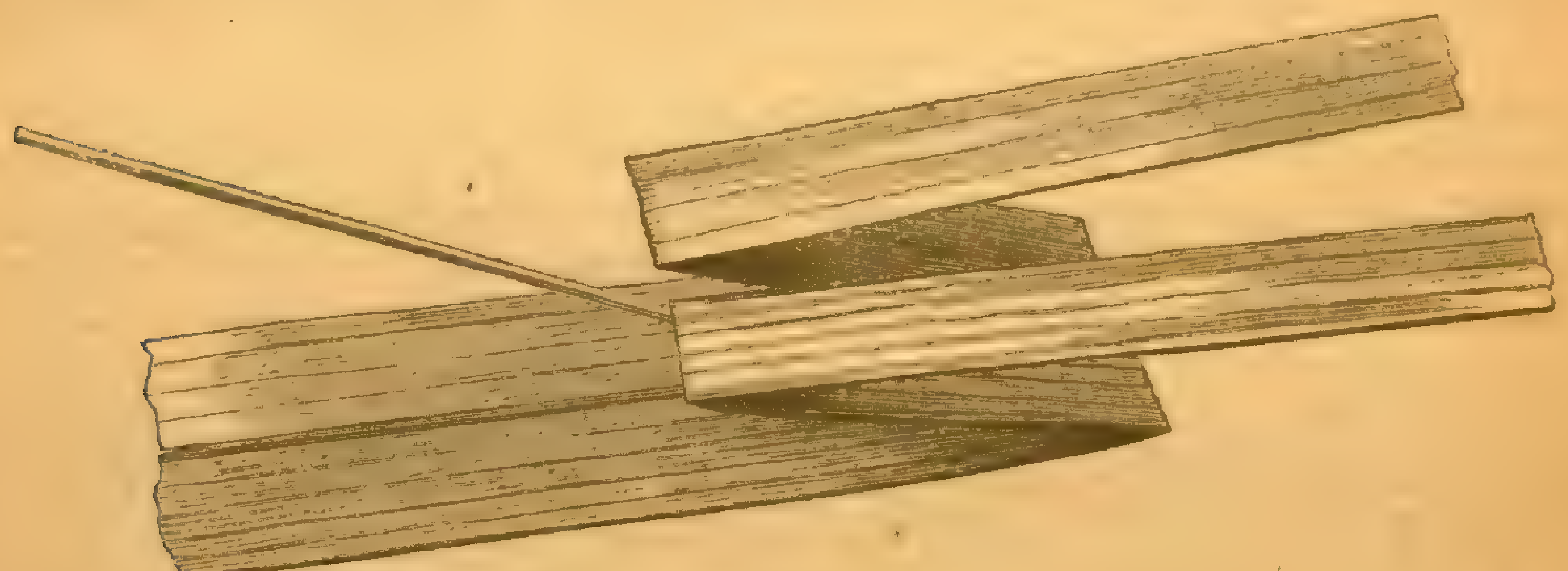

Fig. 1. First stage in preparation of oil-palm leaf for fibre.

It is next taken by the cleft end in the right hand, is laid over the worker's left thigh, and held below the fold in the left hand. The lower part of the folded part is firmly pressed against the leg with the side of the left thumb, the mid-rib being turned back under the same hand. The two loose ends are then pulled separately by the right hand, stripping the tissue from the fibre for the length of the fold, *i.e.*, about an inch (Specimen C.).

The leaflet is now drawn from left to right by the two loose ends across the thigh against which it is held by the flattened left palm, while the thumb of the same hand is inserted between the flap of tissue and the fibre, and is used to help in separating them by raising the

* These specimens are mounted for reference in Museum ii., Case 61.

remaining tissue with an upward and backward motion as it is pulled across the leg (Specimen D.).

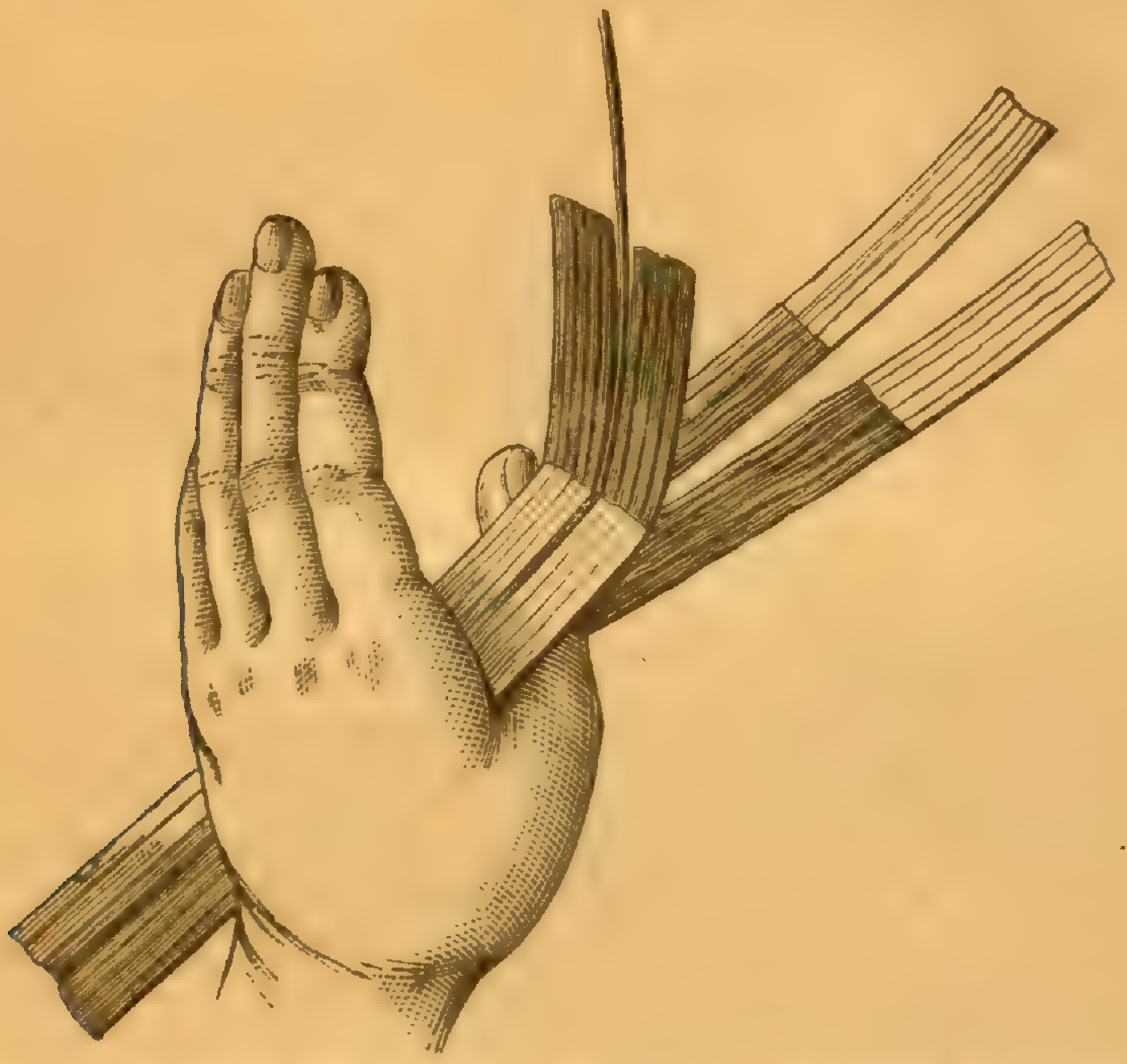

Fig. 2. Splitting of palm leaf to obtain the fibre. The latter is shown below the thumb in sketch.

The loose ends of the divided leaflet are then taken between the right finger and thumb with the fibre hanging over the first finger. The ends of the remaining tags of tissue are patted with the left forefinger for about half an inch of their length above where they join the fibre. This bruised portion is twisted round between the thumb nail and finger so as to separate it from the remaining tissue, and is pulled forcibly through the loose fibre, cleaning it thoroughly as it passes.

The tags with the fibre attached (Specimen E.) are now held in the right hand, and rolled on the thigh in pairs by the left palm so as to twist the fibre into double stranded twine. This primitive method of string making I have noticed also in Central America and among the peasantry in Scotland. Three of these double strands are next made into a cord, and holding the loose green tags of tissue one at a time between the thumb and forefinger of the left hand the remaining fibre is drawn out (Specimen F.) and rolled up on the thigh so as to complete the cord (Specimen G.). The cords are plaited into pigtails, and are hung up in the shade to dry (Specimen H.).

After they are thoroughly dried the short lengths are made into lines by rolling on the leg and inserting new lengths from time to time (Specimen I.).

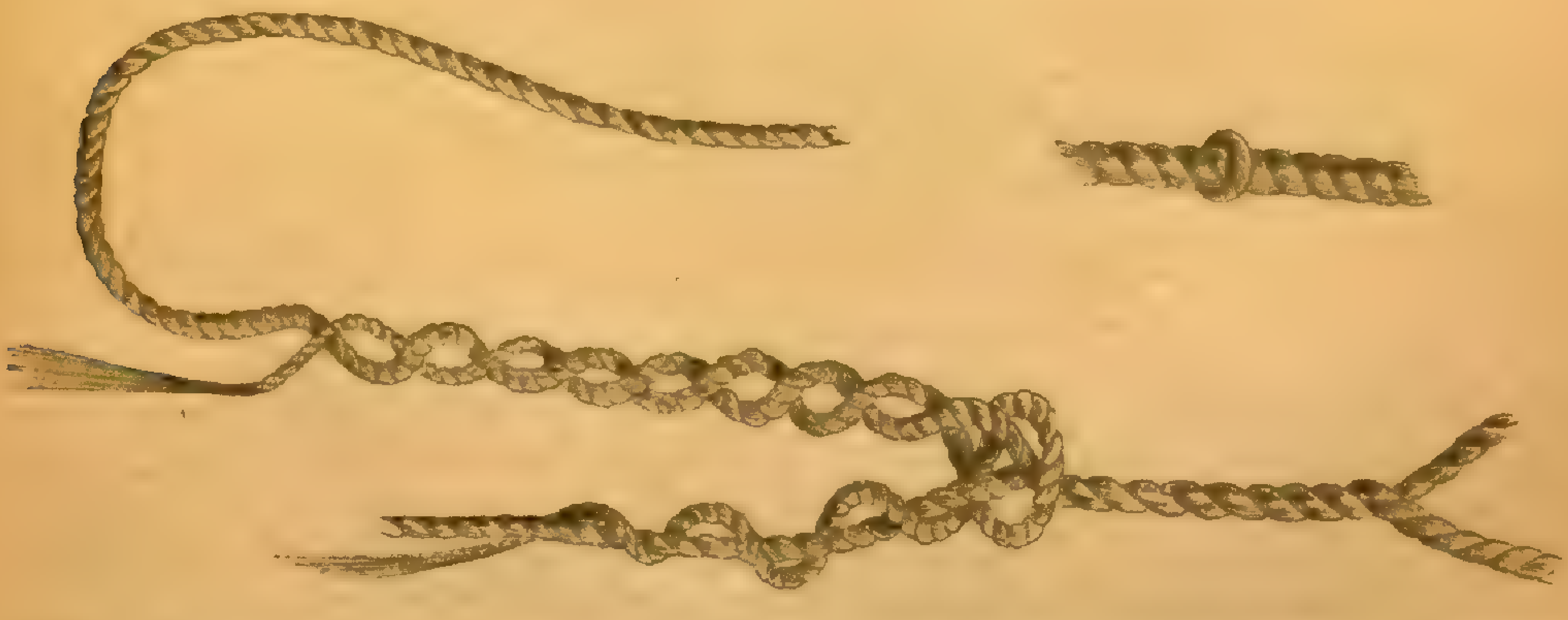

Fig. 3. Sketch illustrating method of preparing fine cord and fishing lines from oil-palm fibre.

The method of insertion, as roughly shown in the above sketch, is unusually clumsy, but has the advantage of strength. In the finer lines the inserted pieces are frayed out at the end, and worked into the material in the usual manner.

So far as can be ascertained the only use to which this fibre is put is the making of fishing lines and fine cords. It would appear to be too costly for native cloth, net or bag making. The following results of actual experiments will serve to show the tedious and expensive nature of the process which has just been described.

A day's hard work is counted well spent on the production of six ounces of fibre from 36 pounds of the raw material. Estimating the value of labour to the native at not more than 3*d.* a day, and leaving out of consideration the time expended in collecting and sorting the leaves in the forest, the actual cost of this material to the producer cannot be calculated at less than 75*l.* a ton. It is therefore clear that it would be impossible to develop an export trade in this article at the present rate of European prices.

(Signed) ALVAN MILLSON,
Assistant Colonial Secretary.

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## CCXXXVI.—SOURCES OF RUBBER SUPPLY.

Para rubber is the produce of *Hevea brasiliensis*, Muell. Arg., a tree belonging to the natural order *Euphorbiaceæ.* The rubber is obtained from incisions cut through the bark, from whence the sap trickles into small bowls and is finally cured by being ladled on to a paddle-shaped implement and held over a stove in which Urucury Nuts (*Maximiliana regia*) are burnt as the fuel. In Museum No. 1, Case 94, will be found a fine series of articles used in collecting and preparing this rubber for export, and also numerous samples of the rubber. In 1891 the estimated export of Para rubber amounted to 17,700 tons, of which 6,000 tons were imported into this country.

A sample of rubber from *H. brasiliensis*, grown at Mergui, India, was reported upon in this country in 1889 as worth 1*s.* 11*d.* per lb.

Ceara rubber or "Ceara Scrap" is afforded by *Manihot Glaziovi*, Muell. Arg., a tree native of South America and belonging to the natural order *Euphorbiaceæ.* The imports of this rubber into this country amounted to 180 tons in 1891. In Case 96, Museum No. 1, will be found samples from Brazil, and also from plants introduced into Ceylon, Zanzibar, and Natal.

Mangabeira or Pernambuco rubber is extracted from a small tree (*Hancornia speciosa*, Gomez.) of the natural order *Apocynaceæ.* Specimens of this rubber are shown in Case 72, Museum No. 1.

The principal source of Central American rubber is *Castilloa elastica*, a large forest tree of the tribe *Artocarpeæ* of the natural order *Urticaceæ.* It affords the Ule of British Honduras as well as Nicaragua, Guatemala, Mexico, and Guayaquil rubbers. The total imports of Central American, West India, Columbian, Carthagena, and Guayaquil rubbers during the year 1891 amounted to 100 tons. *See* Case 100, Museum No. 1.

Esmeralda of Guiana may perhaps be afforded by *Hevea* sp. or *Sapium* sp. of the natural order *Euphorbiaceæ.*

Columbian india-rubber and "Carthagena" are one and the same thing, as is pointed out in the *Kew Bulletin*, 1890, p. 149. The tree yielding this rubber is *Sapium biglandulosum* of the natural order *Euphorbiaceæ*, a widely spread and variable species; it is also the source of Touckpong or Cumakaballi rubber of British Guiana. Case 96, Museum No. 1, contains specimens of these rubbers.

Assam rubber is the produce of *Ficus elastica*, a large tree of the *Artocarpeæ* tribe of *Urticaceæ*. The imports of Assam and Rangoon rubber (also from *F. elastica*) amounted to 350 tons in 1891. Specimens may be seen in Case 99, Museum No. 1.

Borneo rubber is afforded by species of *Willughbeia* and *Leuconotis*, allied genera of the natural order *Apocynaceæ* (*see* Kew Report, 1880, p. 43); 200 tons of this rubber were imported into this country during the year 1891. Samples will be found in Case 71, Museum No. 1.

African rubber is furnished by several species of the genus *Landolphia*, woody climbers of the natural order *Apocynaceæ*. The best quality from the Zanzibar coast is derived from *L. Kirkii*; two other species, viz., *L. florida* (the chief source of Mozambique rubber), and *L. petersiana* are also sources of the East African supply.

On the west coast *L. owariensis*, which has a very wide distribution, is the principal species furnishing Congo and Sierra Leone rubbers. *L. florida*, which occurs on the east coast, and *L. Mannii* also afford part of the West African supply. Liberian rubber is perhaps in part afforded by the "Abba" tree (*Ficus Vogelii*), of the *Artocarpeæ* tribe of *Urticaceæ*, and has already been fully discussed in the *Kew Bulletin* for November 1888 and May 1890.

Messrs. Hecht, Levis, and Kahn give the following statistics concerning these rubbers for 1891, viz.:—African imports, 4,350 tons; Mozambique, 380 tons; Madagascar, 300 tons. Case 71, Museum No. 1, contains samples of these rubbers.

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The following review of the sources of rubber supply from the commercial side has appeared in *The India Rubber and Gutta Percha and Electrical Trades Journal*, January 8, 1892:—

There are merchantable in New York between 30 and 40 different sorts of india-rubber, the variations determining the selection by manufacturers in the purchase of stocks, says I. A. Sherman in the *India-Rubber World*. Of course, rubber in all its variations is essentially the same, differing somewhat in the same degree as the pumpkin in South Dakota from that in New England—one large and another small, one with little flavour and the other richer in food qualities. The difference between sorts of rubber, however, is due in large measure to the methods employed in gathering the sap. It happens that the natives of the Amazon Valley have always taken pains in the curing of rubber. While climatic conditions in that country may have had their influence upon the character of "Para," the condition in which this rubber is exported has become a prime factor in making it a favourite with manufacturers. On the other hand, some of the African sorts are so full of bark and stones as to make them almost unfit for use. At one time "Assams" were almost unmarketable in New York, the price sinking as low as 10 cents per pound, and not wanted at that. One firm, after long experimenting, discovered a chemical solution in which the rubber was washed, the process being that the bark and other impurities absorbed the chemicals, making them so heavy that they

separated from the gum and fell to the bottom and away. This company made a fortune in a moderate space of time; but they put up gradually the price of Assams, from the fact of their creating a demand for that sort of rubber, until the profits became comparatively small, when they disposed of the privilege of washing to some leading rubbermen, who use the process at the present day.

Para rubber is more largely consumed in the United States than any other. It may be noted, also, that the larger share of the rubber exported from Para comes to this country. There are three grades—fine, medium, and coarse. Fine Para is the standard by which all other grades are measured; it brings the best price, and probably is more used than any other. Should it become irregular in quality in the operation of curing over the smoke of palm nuts—as when little strips of virgin gum occur in the grain—it is called "medium," and its price is lessened by a cent or two per pound.

The "coarse" is imperfect, being composed of the scrapings and refuse of the fine sorts, and sells for about two thirds of the price of the better grade. It shrinks considerably, having much water in it, and the importer generally is in a hurry to turn it over to the manufacturer. There are again many variations in Para rubber coming from different localities on the Amazon. This subject is involved in some obscurity; but the best rubber is supposed to be found on the River Purus, a tributary of the Amazon, having its source in the Andes. Brazilians, however, are apt to believe that the locality of the best sorts is unknown to Americans, and possibly the Purus may not be the locality.

There comes from Peru, at the sources of the Amazon and its tributaries, a rubber resembling the Nicaragua sheet, and called Caucho. This rubber is very wet, and consequently shrinks very much, which is a serious drawback. It is considered a good strong rubber, and it is utilised to a considerable extent by the boot and shoe manufacturers.

Of Ceara rubber, there are three grades, numbered one, two, and three respectively. It is called a "mule gum," the significance being that it is neither one thing nor the other, it being so deficient in elasticity as to cause some to argue that it is not rubber. It is a very dry rubber, its gathering being peculiar. The tree is incised at the beginning of the dry season, and as the gum oozes from the wound it forms on the outside of the bark, to be pulled off at the end of the season. The gathering of this rubber seems to be on the wane, for every year there is an extensive migration of Ceara people to Para, bound for the forests of the Amazon.

From Bahia and Pernambuco, in Brazil, comes a rubber of a different grade from that of Para. It is cured with alum and salt water. The Pernambuco comes in sheets, and is of a yellowish-white tinge. That from Bahia is not so good, and comes in round balls. The principal objection to it is that it is very damp, entailing a large loss to the importer from shrinkage.

Of Mangabeira rubber, there are three grades, very similar to the Bahia and Pernambuco sorts. A grade that has a red look is considered superior, and sells for 5 or 10 cents per pound higher than the others.

From Central America comes a variety of rubbers, distinctive in name theoretically, but owing to the lines of transportation centering at Greytown, and the trans-shipment at that point to New York, there is much confusion, one sort often getting substituted for another. The Pacific mail steamers gather also different varieties at Panama with the same confusion. That which comes from Nicaragua is called Nicaragua

"sheet" and "scrap." The latter comes in pieces about $2\frac{1}{2}$ feet long, weighing from 10 to 40 pounds. In the gathering of rubber in the forest, around the cuts in the tree a residuum is left, which is given to the man as a perquisite, and this forms "scrap." As in the peculiar mode of gathering, it is very dry, there is little loss in shrinkage, and this quality makes it a favourite with manufacturers. It contains some bark, but not so much as the "sheet." The sheet, after it is milled and washed, is the same rubber as the "scrap." Both are cured by the use of a vine from which a soapy [? alkaline] substance is formed.

There is another grade which comes from Central America, containing a considerable amount of ashes, due to its being smoked over the latter. It comes in thin sheets $\frac{1}{2}$ to $\frac{3}{4}$ inch thick. It is a dry rubber, there not being so much loss in shrinkage; but it is not so firm as the other grades, and it is difficult to work. There also comes from Central American ports a rubber which is chiefly grown in New Granada, and is called "Carthagena strip." It is from $1\frac{1}{2}$ to 2 inches thick, and there is a great deal of sand and dirt in it. It is a black, tough rubber.

Honduras furnishes a great deal of rubber of the Tuno sort, which is found in many other sections of Central America. Guatemala ranks low in the American varieties, containing a resinous substance which gives it a tarry appearance. It comes in sheets pressed together. There is a rubber which comes from Angostura as good as Para. When cut it is found to contain little spots of white as large as a pea. Tuxpan, Mexico, once sent a fine grade of strip rubber; but as the trees have been destroyed by cutting them down instead of tapping for rubber, the imports from there are now very small. The rubber is gathered by scraping from the bark.

Guayaquil comes in large flakes or lumps of a whitish colour in the best sorts, the inferior sorts being porous and exuding a black liquid which stains the knife and hands. As in a great many "Centrals" the name is often confounded with the sorts.

Esmeralda comes from Guiana, is a strip rubber, and is also made into "sausages." Some brokers are of the opinion that very little of the real Esmeralda finds its way to America, it being almost indistinguishable from other grades. It brings a high price. Certainly little of it finds its way to Europe, brokers not quoting it there. A great deal of the rubber gathered in Columbia finds its way to the Amazon and Para.

In rubber from Asia the Assams probably take the lead, and are rated above coarse Para in price. There are three or four grades, the lower ones being very dirty and all of them requiring much washing.

There are two grades of rubber coming from Borneo. The rubber from that source was first called a gutta, on account of its geographical location, but this error was a palpable one, and soon corrected. It is a white, soft, porous or spongy rubber, the pores being filled with salt water or whey. The better grade is a fair rubber, but the second grade is often when cut almost as soft as putty and practically worthless.

Of Africans there are many varieties. The favourite sorts come from Madagascar. The pinky sort comes in the shape of round balls, weighing $1\frac{1}{2}$ to 4 pounds. It is not so strong as fine Para. There is always a good demand for it, and it is rarely found in store, being sold "to arrive." This sort comes from Tamatave. There are two or three variations in quality of Madagascars, but the grade called "black" comes from Majunga, is exported in small balls, and has a dark colour when cut.

From the West Coast of Africa there are many varieties, the best coming in the shape called "thimbles," which are square pieces one inch each way. The rubber is very dry, and is in good demand by mechanical goods manufacturers. It is very strong rubber, and naturally has little shrinkage. Tongues are shaped as their names indicate. There is considerable shrinkage, but it is a very good rubber. There is also a small ball rubber about 1¼ inches in diameter. It cuts white, and is fairly firm.

Congo ball is made from small strips of rubber and rolled into balls, from 1 to 2½ inches in diameter. It is a firm and very elastic rubber, but there is more or less bark in it, and as manufacturers do not always have proper machinery to exclude it, they do not buy readily.

Sierra Leone comes in balls 3 to 4 inches in diameter, and is a very fair grade of rubber. It has a considerable demand from boot and shoe and mechanical goods men. Like all West Coast rubbers it reaches us by way of Hamburg or Liverpool.

The finer grade of Mozambique is called "white ball." It resembles Congo ball in appearance, and comes in about the same shape. The "red ball" is mixed with a reddish bark, and gets its name for that reason. Oftentimes both varieties of "ball" will be found filled in the centre with bark. The rubber is then called "unripe Mozambique," and sells for 10 cents less per pound.

From Liberia comes a lump rubber. There are three rivers in Liberia from which rubber is gathered, but it is all assembled at the common mouth and the grades are not kept separately, making a class of rubber which is very variable, and therefore disliked by manufacturers.

There is, on the whole, a growing tendency toward the use of Africans, and in this is a true check on the price of Para. In Centrals there seems to be a falling off in the production consequent upon a scarcity of labour, which has been from time to time drawn into internal enterprises In Europe the stocks of Africans are always larger than of Para, and a steady growth is very noticeable.

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## CCXXXVII.—MISCELLANEOUS NOTES.

A set of some 2,000 species of the late Dr. J. Triana's New Granadan plants has been purchased for the Herbarium. Dr. Triana worked at Kew on this collection of plants, especially the *Melastomaceæ*, on several different occasions and altogether for a considerable period, but other duties prevented him from continuing his botanical studies, and the flora of New Granada on which he was engaged came to a standstill from want of funds. He presented Kew with a set of his plants, as far as he had worked them out.

A small but excellent collection of Dahurian dried plants, made by Mr. F. Karo, has also been acquired by purchase. The flora of this region is tolerably well known, though not very fully represented in the Herbarium by really good specimens.

From the Berlin Herbarium (Dr. A. Engler, Director,) has been received a further donation of duplicate dried plants, including upwards of 200 species from New Guinea, and a smaller number of novelties. The Germans are actively collecting in their African and New Guinea possessions, and the Berlin botanists are equally active in publishing the results.

After a rather prolonged delay the Commission for the Delimitation of the Anglo-French frontier in the neighbourhood of Sierra Leone was appointed, and Captain Kenney, R.E., the British Commissioner, with his party, proceeded to Sierra Leone in November last. The Secretary of State for the Colonies permitted the Director of Kew to nominate a botanist to accompany the expedition, and the Government Grant Committee of the Royal Society made a grant to meet his expenses, part of which will also be borne by the Government of Sierra Leone. The mission has been undertaken by Mr. G. F. Scott-Elliott, M.A. Camb., B.Sc. Edinb., F.L.S., who has made collections in Madagascar and published the results in the Journal of the Linnean Society. The botany of the interior of Sierra Leone is very little known, but it is believed to be of great interest. So far Mr. Scott-Elliott has forwarded to Kew in five consignments about 500 species of dried plants in excellent condition, and also seeds of various kinds. The critical examination of these collections will be deferred until Mr. Scott-Elliott's return.

Mr. H. Millen, Curator of the Botanical Station at Lagos, on leave in this country, brought home a small collection of dried plants, which have been determined. Among them are good specimens in fruit of *Usteria guineensis* and of *Urophyllum* (*U. hirtellum*, Benth.), but the majority are the common plants of the tropics.

*Calostemma album*, R. Br.—Two large bulbs of this rare and interesting plant (natural order Amaryllideæ) were recently received at Kew in excellent condition from Sir Ferd. von Mueller, K.C.M.G., Government Botanist, Victoria. They were obtained from Turtle Islands by the Honourable John Douglas, C.M.G., resident magistrate, Thursday Island, who made a special voyage to obtain them. The plant is not known from any other locality. Baker, *Handbook* of Amaryllideæ, p. 132, describes it as somewhat similar to *Eurycles Cunninghami.* It has not before reached this country in a living state, and considerable interest will be attached to it when it first comes into flower.

Erythroxylon Coca.—As there is still some demand for this plant among correspondents in tropical countries, attention may be called to the fact that fresh seeds of it may be sent long distances without losing the power to germinate. A quantity of seeds of the typical plant, with broad-pointed leaves, received at Kew from Ceylon on January 29th, and sown at once in a tropical house, have germinated freely. They were packed in a small tin box in slightly moist soil and sent from Ceylon by post. Plants of *Erythroxylon* do not travel well in Wardian cases.

Mahogany cutting is one of the chief industries of British Honduras. The export of timber varies from about 4,000,000 feet to about

6,000,000 feet per annum. The annual value is about a quarter of a million sterling. The mahogany forests are cut over once in about fifteen years. The trees are selected and cut down generally above the large slab-like buttresses which grow out of the base of the stem. They are then squared into convenient logs and drawn on heavy trucks to the nearest stream. The broad, massive wheels of these trucks are sometimes cut out of the slab-like buttresses of the mahogany trees or by sawing pieces across the stems of Santa Maria trees (*Calophyllum Calaba*). Recently Sir Alfred Moloney, K.C.M.G., Governor of British Honduras, forwarded to Kew two truck wheels that have been in use in the mahogany forests, consisting of cross sections, about 12 inches thick, of mahogany and Santa Maria trees. These are roughly trimmed and pierced for the axle.

A monograph on the wood manufacturers of the Punjab was recently received from the Government of the Punjab and its dependencies [Lahore, 1889]. Amongst the articles described were many not included in the Museums of Economic Botany at Kew. It was desirable to obtain these to illustrate the use in the Punjab of various local woods and timbers. The Government of India has lately obtained most of the articles desired, and others are in course of being procured. The articles received consist of native combs made of the following woods:—*Tamarix orientalis*, *Flacourtia sapida*, *Holarrhena antidysenterica*, and *Ougeinia dalbergioides*. The collection also includes sword scabbards made of the soft, light wood of *Bombax malabaricum*, and lacquered boxes, the wood chiefly used being *Dalbergia latifolia*.

CASUARINA EQUISETFOLIA, Forst. (C. muricata, *Roxb.*), is known as the Beefwood tree. It is fast-growing and yields excellent timber. It has been successfully established in large plantations in the neighbourhood of Madras, and it thrives in poor sandy soil close to the sea. Colonel Campbell Walker, Conservator of Forests, Madras, estimates the yield of firewood from this tree for locomotives and other purposes, to be four times as great as the return from any tree grown for the same purpose in France. The timber, although somewhat heavy, is valuable also for building purposes. The tree is not attractive in appearance on account of its thread-like jointed branches without leaves, but it withstands strong winds, and it may be usefully employed if planted thickly, to form shelter-belts against sea-breezes, to mask earth-works and batteries, and even to drain somewhat boggy saline lands. In these respects it is much superior to the Blue-Gum tree (*Eucalyptus Globulus*) which is not at all suited to tropical conditions. During the last two years efforts have been made to establish *Casuarina* trees on the West Coast of Africa. Large supplies of seed have been received through the India Office from the Agri-Horticultural Society of Madras, and the seed has been distributed from Kew to all the West African settlements.

The Annual Report of the Botanical Department, Jamaica, for 1890, contains an interesting notice of the Botanical Gardens at Castleton, about 19 miles from Kingston. This is the tropical garden of the Colony. The *Jamaica Post* reviews this notice as follows:—Mr. Fawcett in his account of the state of the Castleton Gardens writes with all the animation of a good guide-book to the place. "The

garden," he says, "has attracted a large number of visitors. During "18 months, 896 names have been entered in the visitors' book, or on "an average of 50 a month. Those who come from abroad, and more "especially those from temperate regions, are very much struck with "the beauty of the garden and the interesting character of the plants "growing in it. Mr. Morris, who was here in February, said that he had "not seen as pretty a garden since he left Jamaica. Mr. William Saunders, "Superintendent of Gardens, Agricultural Department, Washington, "when he heard that it had been in contemplation a few years ago to "give up the garden, remarked that to do so would be like burning down "a picture gallery. But those also who live in Jamaica, and are "accustomed to tropical vegetation, appreciate the pleasure and profit "to be derived from a visit. The drive from Kingston, though a "long one, is full of interest, first through the Liguanea plains, then "up Stony Hill, past Settlers' groves of cocoa, coffee, and bananas, "with a sprinkling of oranges, akees, sugar cane, annatto and yams; "down into the Wag Water Valley with broad alluvial stretches "covered with tobacco, cultivated by Cubans; along the winding "river, fringed with clumps of graceful bamboo plumes, and its banks "hidden by masses of creepers; past the rocks by the roadside covered "with ferns and mosses, the scarlet 'dazzle' *Euphorbia* (*Poinsettia*) "*pulcherrima* and the blue 'forget-me-not' of Jamaica (*Browallia*) "until Castleton is reached, where 'art shows nature at its best, by "'world-wide selection and harmonious combination.'

"A guide-book that took in all the Jamaica gardens in the manner of "the above paragraph, would be useful, and would add to the number of "visitors to all of them. Of the plants in the garden at Castleton some "most interesting information is supplied. 'One of the most superbly "'beautiful of trees,' says Mr. Fawcett, 'the *Amherstia nobilis*, was "'in magnificent flower this year, and was worth crossing the globe "'to see. Though covered with its long pendent bunches of vermilion "'and yellow flowers, it only yielded a few seeds. It is a native of "'the Malay Peninsula, and naturally prefers a moist climate. One "'of the Iron Woods of India, *Mesua ferrea*, also attracts attention "'from the red colour of the young drooping foliage, and the large "'fragrant white flowers. It has not yet ripened seed. The Man- "'gosteen, *Garcinia Mangostana*, the fruit of which in its native "'country is said to be the most delicious in the world, yielded a "'small crop again this year. It requires a damp and hot atmosphere, "'and probably the eastern end of the island would be the most "'suitable situation in which to cultivate it. The Traveller's Tree "'of Madagascar (*Ravenala madagascariensis*) is the noblest form of "'that essentially tropical family—the banana order (Musaceæ). The "'leafstalks contain water, a merciful provision for the thirsty traveller.'"

The *Colonial Standard*, January 18, 1892, discusses an important matter connected with the Jamaica Botanical Gardens as follows:— The first step in this Colony towards the technical education of the young, in agricultural matters at least, has been initiated at the Industrial School at the Hope Botanical Gardens. The boys there have, by the direction of his Excellency, who has always evinced a hearty interest in whatever relates to the agricultural welfare of the Colony, been trained under a skilful instructor in the mysteries of cocoa curing,

a science which is yet in its infancy in this island, and through ignorance of which incalculable loss is sustained to growers. His Excellency has directed that a quantity be dried and cured at Hope and sent to the London markets to compete with the ordinary triage produced by the peasantry by the rule of thumb methods, which at present characterise the manipulation of the bean in the country. The prices obtained will be published in a comparative statement to show growers how much is lost by ineffective methods of drying and curing. The Botanical Gardens or land, under cocoa cultivation at Hope, do not suffice to produce the quantities of cocoa that can be handled by the boys, and consequently recourse has to be had to the small growers who sell the bean in the pod. More education of a technical and less of a classical nature would result in producing such an impetus as would put Jamaica into the forefront of the race for commercial supremacy among cocoa and coffee growing countries. The usefulness of the Institution at the Hope is making itself felt in a very tangible way, but similar training classes must be established all over this island before the result desired can be attained.

Another interesting experiment is being tried at the Hope Gardens in the training of two respectable young Africans destined eventually to take charge of Botanical stations on the west coast. Mr. Fawcett reports upon them as follows:—

"The Government of Lagos has sent here two apprentices to be trained in practical work at the Botanical Gardens in Jamaica, with a view of hereafter appointing them as 'working superintendents of the district branches or outstations' in their own country. They were about 19 years of age when they arrived, and had received a fair education. A room is granted to them at Hope Gardens, and their Government allows them each a provision of 50*l*. per annum. I have from the commencement of the negotiations on the subject made it clear that it was not possible with the present staff to undertake any tuition, but that if the apprentices had received a good education, they would be able to read and understand such books as were given them treating of the fundamental principles of gardening and agriculture.

"The plan has been carried out, and so far has proved satisfactory. The apprentices have worked in the Hope Gardens, as gardeners work in the Kew Gardens. They are learning the elementary practice of gardening, and the use of tools, and are as far advanced as can be expected after less than a year's work. I am satisfied with their industry in this respect, and expect that after another two years they will be fairly proficient."

In a note in the *Kew Bulletin* for October, November 1891, p. 277, it is stated that efforts had been made at Kew for some years to introduce the "butter-nut" of British Guiana (*Caryocar nuciferum*) to the tropical parts of the Old Word. The following report from Mr. W. Soutter, Secretary of the Acclimatization Society of Queensland, dated Brisbane, January 19, 1892, shows that in that Colony the effort so far has been successful:—

The box containing seeds of *Caryocar nuciferum* came safely to hand, and I am directed by the Council to thank you for the same.

Several plants were raised here from seeds furnished by your gardens some years ago. The latitude of Brisbane is, however, not conducive to the perfect growth of the "butter-nut." It thrives well in more

northern latitudes, to wit, the "Johnstone River." A pair of plants sent there have done remarkably well; the majority of the present lot will finally reach that locality.

We are having splendid crops of fruit this season, of all sorts. There is a phenomenally heavy crop of Litchis (*Nephelium Litchi*), the heaviest ever known here. Grapes are selling at one farthing a pound; mangoes at 6*d*. to 8*d*. per dozen; persimmons are better at 3*s*. to 5*s*. per doz.; pine-apples at 1*s*. to 3*s*. per doz.; bananas are practically unsaleable. Queensland has had one of the best growing seasons it has enjoyed for the past 15 years.

Gambier (*Uncaria Gambier*, Roxb.) was fully discussed in the *Kew Bulletin*, 1889, p. 247. The interest in this valuable tanning plant appears to be maintained, and efforts are being made to establish its cultivation in other countries. The following interesting report from Mr. Henry Walker, Commissioner of Lands, Sandakan, has been communicated to Kew by Mr. William M. Crocker, the manager of the British North Borneo Company, 15, Leadenhall Street, E.C.:—

"I am pleased to report that the Gambier plantation on the Crocker Road of which I took charge in September appears likely to be a great success. Up to the end of September, 100 pepper cuttings and a few Gambier plants had been planted, and have since been increased to 587 pepper cuttings and 3,020 Gambier plants; of the latter there has not been a single failure and all are growing remarkably strong and well, generally with more than one shoot. The Gambier Hill has just been cleaned up and the plants appear about 16 inches to two feet above the ground. The Chinese gardeners speak enthusiastically of the growth of the Gambier, and say it beats anything they ever saw in Singapore, and they expect to take a cutting at 10 months old.

The troubles we have had in getting pepper cuttings from Singapore have prevented any extensive plantings, but I have just received 1,155 pepper cuttings through Mr. Joseph Wheatley by one of the Chinese gardeners whom I sent to collect cuttings at Bunda. These have arrived in very good order.

Since my return I have taken in hand the distribution of economic plants, and as I found a large number of coffee seedlings under the trees in the Silam gardens, I arranged to have some boxes sent up by each trip of the "Normanhurst." The Ceylon coffee seeds bought by me are not yet all to hand. Mr. Dunlop writes me from Penungah (acknowledging some seeds) to say he has found three coffee trees planted at Senanghal two years old and bearing well. They were planted by Hadii-Moussa at my request.

I have laid down a large quantity of Gambier seed, but it takes a few months' time before it is available for planting, and I am taking two Chinese to Labuan who will collect pepper cuttings and return as soon as possible. We shall then be able to carry out the object with which the garden was started, viz., the distribution of pepper cuttings and Gambier plants, and later on we shall be able to collect our own Gambier seed, which will be a boon as it suffers from the transport from Singapore. I gave some Gambier seed to one of the estates in Marudu Bay to make a trial planting and to ensure a supply of seed for that district. I am taking some to the west coast to give to the pepper planters.

ROYAL GARDENS, KEW.

# BULLETIN

OF

# MISCELLANEOUS INFORMATION.

No. 64.] APRIL. [1892.

## CCXXXVIII.—FIJI GINGER.

(*Zingiber officinale*, Rosc.)

The ginger plant is not known in a truly wild state, but it is believed to be a native of tropical Asia. It is now cultivated in all the warmer countries of the globe. Ginger is used as a condiment and as a medicine. The preserved ginger of shops is prepared by selecting the young rhizomes, and after being washed and scraped they are preserved in jars with syrup. As a rule Jamaica ginger is most valued, and after that come Cochin, Bengal, and African sorts. The bulk of the preserved ginger comes from China (*Kew Bulletin*, January 1892, p. 16). Ginger is regarded as an exhausting crop, and it can only be grown on the same land for a limited number of seasons. The soil should be rich and cool (moderately moist), and the rhizomes require to be taken up at the end of the season of growth when the leaves show signs of withering.

Dry or green ginger is generally imported into the United Kingdom in barrels weighing about one hundredweight each. The quantity imported in 1889 was 63,511 cwts., of the value of 97,716*l*. In 1891 this had fallen to 17,436 cwts., of the value of 54,553*l*. Candied and preserved ginger in syrup is no doubt included under "succades," but is not separately given.

In many new colonies an attempt is generally made to grow ginger. The plant is readily propagated, and provided the soil is good and not too dry, the crop is abundant. There are, however, practical difficulties experienced in preparing the rhizomes for market, and, in some instances, the cultivation has become stationary or been abandoned on that account. Apparently this difficulty has been lately felt at Fiji. The aid of Kew was sought, and as shown in the following correspondence there is some hope that Fiji ginger may become an article of local industry.

ROYAL GARDENS, KEW, to COLONIAL OFFICE.

SIR, Royal Gardens, Kew, March 5, 1892.

I AM desired by Mr. Thiselton-Dyer to inform you that at the request of Sir John B. Thurston, K.C.M.G., Governor of Fiji, there

was recently received at Kew a sample of cured ginger prepared at the Botanical Station at Suva by the Curator, Mr. D. Yeoward.

2. In a letter received from Mr. Yeoward on March 29, 1891, he said, "I am seeking to acquire, if possible, some information on the "proper way of curing ginger for export. On my arrival in the "colony I found a large quantity of ginger was growing in the former "botanical garden established by the Governor. After the leaves had "withered down (and while the rhizomes were in a resting stage) they "were taken up. A large quantity was distributed amongst planters "throughout the group, and I myself planted about half an acre here. "Last year, upon taking up the rhizomes, I experimented on some for "curing. Excepting during the process of scalding I only allowed "them to remain in the water for about five minutes. After this I "placed them on the verandah in the sun to dry, but dry they never "would. About six weeks afterwards they commenced to grow."

3. In response to Mr. Yeoward's request a copy of instructions for curing ginger, prepared at the request of Sir William Robinson, K.C.M.G., when Governor of Trinidad, was forwarded to him, and on August 7, 1891, he wrote, "I have to acknowledge the receipt of your "letter, dated March 30th, 1891, and I have to express my thanks for "the copy of instructions on the curing of ginger which will be put "into force. I do not know yet how the sample will turn out, time "will prove."

4. The present sample of Fiji ginger has probably, therefore, been cured according to the instructions furnished from Kew. When it reached Kew it was attractive in appearance, and of good colour and flavour. For the purpose of obtaining a commercial report upon its quality and value it was submitted to two eminent firms in the City, and a copy of their replies is enclosed herewith. It will be noticed that there is a slight divergence of opinion as regards the actual market value of the sample. Messrs. Lewis and Peat place the present value at 40*s.* to 42*s.* per cwt., while Messrs. W. and D. Harvest are of opinion it is not worth more than 34*s.* to 36*s.* per cwt. The result of the reference is, however, of a sufficiently satisfactory character to encourage further effort being made to prepare Fiji ginger. As a first attempt the sample is certainly a good one, and Sir John Thurston, who takes so deep an interest in the development of industries at Fiji, may be congratulated on the result so far attained in growing and exporting ginger as a local industry.

I have, &c.
(Signed) D. MORRIS,
Assistant Director.

The Hon. R. H. Meade, C.B.
Colonial Office, S.W.

[Enclosure 1.]

MESSRS. LEWIS AND PEAT to ROYAL GARDENS, KEW.

6, Mincing Lane, E.C.,
March 3, 1892.

DEAR SIR,

WE are in receipt of your favour of yesterday, with sample of ginger from Fiji.

We have carefully examined same, and find it good plump white, part hard and part soft; present value about 40*s.* to 42*s.* per cwt., prompt 14 days, less $2\frac{1}{2}$ °/ₒ discount.

The market is a good one, owing to short crops of Cochin and Calicut descriptions.

Always at your service.

We are, &c.
(Signed) LEWIS AND PEAT.

[Enclosure 2.]

Messrs. W. and D. Harvest to Royal Gardens, Kew.

Dowgate Dock, Upper Thames Street, E.C.,
March 3, 1892.

Dear Sir,

We have examined the sample of Fiji ginger, and believe its present commercial value in London to be about 34*s*. to 36*s*. per cwt. The quality is very inferior to the ordinary East India ginger or that produced in the island of Jamaica, being rather hard and unsuitable for many purposes for which ginger is now used. The ginger produced in Japan bears a strong resemblance to your sample.

We are, &c.
(Signed) W. and D. Harvest.

We may remark that the value of East India ginger during the last two or three years has advanced from 100 to 120 °/ₒ.

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The following instructions in regard to the cultivation and curing of Jamaica ginger were printed at the request of Sir William Robinson, K.C.M.G., for distribution by the District Agricultural Boards, Trinidad, 11th October 1886:—

Ginger is propagated by the smaller pieces, prongs, or protuberances of the root, each of which throws up two different stems; the first bears the leaves, and rises to the height sometimes of three feet or upwards, but its usual growth seldom exceeds 18 inches. It thrives best in a rich, cool soil, and, therefore, what has been recently cleared from wood is well adapted to the culture of it, more especially as it is supposed to be a great impoverisher of land. In such a soil it grows so luxuriantly that a hard or large spreading root will weigh near a pound. It is, however, remarked that what is produced from a clayey, tenacious soil shrinks less in scalding, while such as is raised in richer, free, black moulds loses considerably in that operation. The land intended for the cultivation of it is first well cleaned with the hoe, then slightly trenched, and planted about the month of March or April. It attains its full height and flowers about August or September, and fades about the close of the year. When the stalk is entirely withered the roots are in the proper state for digging. This is generally performed in the months of January and February. After being dug they are picked, cleansed, and gradually seethed or scalded in boiling water, they are then spread out and exposed every day to the sun till sufficiently dried, and after being divided into parcels of about 100 lbs. each, they are packed in bags for the market; this is called the *black ginger*. The manner of scalding the roots is as follows:—A large pot or copper is fixed in the field or some convenient place, which is kept full of boiling water; the picked ginger, being divided into small parcels, is laid in baskets, and plunged alternately in the water, where it is suffered to stay for the space of 10 or 15 minutes; it is then spread on a platform for drying; but care is taken during the process to change the water so soon as it becomes much impregnated with the juices of the root.

The white sort differs but little from the black roots. The difference there arises wholly from the methods of curing them; the white is never scalded, but, instead of this easy process they are picked, scraped, and washed one at a time, and then dried; all which requires too much pains

and time for any real advantage to be gained in the properties; though, being made more agreeable to the eye, the price of the white is much higher at market. When the root is intended for a sugar-preserve, it is dug while tender and full of juice; the stems at this time rarely exceed 5 or 6 inches in height; the root is carefully picked, washed, and afterwards scalded, till it is sufficiently tender; it is then put in cold water, and peeled and scraped gradually. This operation may last three or four days, during which it is commonly kept in water, and the water frequently shifted, as well for cleanliness as to extract more of the native acrimony. After this preparation it is laid in unglazed jars and covered with a thin syrup, which in two or three days is shifted and a richer put in; this is sometimes removed for a third or fourth, but more than three are seldom requisite. The shifted syrups are not lost, for in Jamaica they are diluted with water and fermented into a pleasant liquor called cool drink, with some mixture of the chaw-stick, lignum vitæ, and sugar.—*Long's Jamaica*, p. 700.

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Jamaica, 16th October 1886.

I UNDERSTAND that Sir William Robinson wishes for information merely in respect of the *curing* of ginger, not its cultivation.

The method pursued in Jamaica is extremely simple. The ginger being about 10 months to 1 year old from the time of planting, having arrived at maturity begins to wither, the leaves getting yellow and shrivelled. The roots are then dug up, *great* care being taken not to *bruise* them. If the epidermis (skin) of the root is injured, it discolours the product. After the roots are dug, they are carefully trimmed with a sharp penknife and picked and allowed to dry in the air for a few hours until all the accompanying earth can be rubbed or wiped off with a soft cloth. The cleaned roots are then placed a few at the time in boiling water and scalded, and the epidermis is scraped off with a sharpened bamboo like a very narrow flexible paper knife. As soon as scraped they should be placed in the sun until apparently free from dampness. After this the drying is continued. Gradual drying results in a better product than quick drying. A few hours a day in the morning sunshine and in air-drying sheds until after 8 to 12 days the fingers break off sharp and clear. The ginger is then cured and should be sorted, all of one colour being kept separate and large again separated from small. The water used in scalding should be clear and free from iron or excess of lime.

The foregoing really contains all that can be stated in the matter.

(Signed) W. BANCROFT ESPEUT, F.L.S.

Botanical Department, Jamaica,
November 16, 1886.

JAMAICA ginger is cured in two ways, one in producing the commodity known as "uncoated ginger," the other "coated ginger," both saleable in English or American markets.

To produce the "uncoated ginger," which is that prepared for medicinal use, the fresh rhizome is simply scraped, washed, and then well dried in the sun. When thus prepared it should have a pale buff hue, a striated and fibrous surface, should break easily, exhibiting *a short farinaceous* fracture with numerous bristle-like fibres. It is often further prepared by bleaching, being subjected to the fumes of burning sulphur, or immersed in chlorinated lime. Much of that sold in England is coated with calcareous matter, either sulphate or carbonate of calcium.

These bleaching and covering processes are, however, usually performed after the article reaches the first market.

"Coated ginger" is prepared by being dried in the sun without removing the epidermis, which causes the article to assume a crude and wrinkled appearance.

The rhizomes should be collected after growth is made for the season, which may be known by the leaves turning yellow and gradually drying up.

(Signed) J. H. Hart.

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Since the above was in type an interesting note by Mr. E. H. Gane on Fiji ginger (from Kew) has appeared in the *Pharmaceutical Journal*, March 26, 1892, p. 802. This shows that Fiji ginger "is remarkable for its exceeding fine aroma and peculiar pleasant taste." It is also stated to be "by far the richest in active constituents":—

"Though not of such fine appearance as the Jamaica ginger, yet it [Fiji ginger] was finer than the other two commercial varieties, and was especially remarkable for its exceedingly fine aroma and peculiar pleasant taste, recalling that of lemon. The rhizome had evidently been carefully dried, as was evidenced by the small amount of moisture present. The rhizome is rather more fibrous than the Jamaica, and some of the pieces are heavy and resinous, but otherwise the structure appears similar. Its powder is of a slightly darker colour than a fine Jamaica ginger, but about the same colour as the commercial article, and therefore much lighter than either the Cochin or African. The fine lemon-like odour is much more distinct in the powder.

"To examine its active constituents the method adopted by Dr. Thresh was followed. A known weight of the rhizome in fine powder was packed in a percolator and exhausted with alcohol. Alcohol was chosen as the solvent, as all the important constituents of the plant were known to be soluble in it. A similar operation was simultaneously carried out on a sample of Jamaica. The resulting tincture of the Fijian was darker, more aromatic and pungent than that of the Jamaica ginger. * *

"Comparing the results of the above two analyses with those obtained from Cochin China and Africa by Dr. Thresh we have the following figures :—

| — | Jamaica per cent. | Cochin per cent. | African per cent. | Fijian per cent. |
|---|---|---|---|---|
| Volatile oil - - | ·64 | 1·35 | 1·615 | 1·45 |
| Fatty matter - - | ·92 | 1·200 | 1·225 | ·86 |
| Resins - - - | 1·76 | 1·815 | 3·775 | 4·47 |
| Acid and neutral gingerol | ·84 | ·600 | 1·45 | 1·32 |
| Moisture - - | 13·66 | 13·53 | 14·515 | 11·25 |
| Ash - - - | 4·53 | 4·8 | 4·27 | 4·06 |

"On comparison it will be seen that the Fijian ginger is by far the richest in active constituents. The amount of volatile oil obtained seems rather low compared with the powerful aroma of the drug, but probably an appreciable amount was lost, owing to the method of determination, and more accurate methods would lead to a higher figure."

## CCXXXIX.—DECADES KEWENSES.

PLANTARUM NOVARUM IN HERBARIO HORTI REGII CONSERVATARUM.

The energy and curiosity of the British race is inextinguishable. It traverses and explores every part of the world, and pours into Kew a continuous stream of botanical information and specimens. It requires the unremitting exertions of a staff, none too numerous, to prevent these accumulating on its hands.

The collections received in this way, at no cost to the Government, are all examined and reported upon to their donors. When of sufficient magnitude and importance they are made, as in the case of the late Colonel Grant's collections in Central Africa, the subject of a detailed memoir. Anything of sufficient interest in smaller collections is illustrated with a plate in "*Hooker's Icones Plantarum.*" Novelties of insufficient importance to justify a plate have hitherto been relegated to their proper places in the Herbarium, where they await description by some monographer.

It has been found, however, that collectors are best encouraged when they see that the result of their labours supplies some tangible addition to scientific knowledge. It seems expedient therefore to describe, for the information of botanists, and distinguish by formal names all plants received at Kew of which the novelty can be ascertained with some certainty. And in accordance with the principle laid down by the First Commissioner, that the *Kew Bulletin* is to be made the vehicle, as far as possible, of all information which it is thought expedient by the establishment to communicate for public information, successive Decades of plant-descriptions will from time to time be published in its pages.

Species marked with an asterisk are in cultivation in the Royal Gardens.

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### DECAS I.

1. **Clematis Prattii,** *Hemsl.* [Ranunculaceæ]; species inter C. japonicam et C. lasiandram medium tenens, foliis semper 3-foliolatis, foliolis integris vel rarissime obscure paucidentatis, sepalis quam stamina longioribus, carpellis numerosissimis ovoideis pilosis.

*Hab.*—China: Hupeh, in the Patung District, *Dr. A. Henry*, 4920, 6817; Szechuen, on the summit of Mount Omei, *Rev. E. Faber*, 731; North Wushan, *Dr. A. Henry*, 6704; chiefly near Tachienlu, at 9,000 to 13,500 feet, *Mr. A. E. Pratt*, 169 and 238.

Dr. O. Kuntze designates this (manuscript in the Kew Herbarium), a variety, foliolis integerrimis, of *C. japonica*, Thunb., and there can be no question about a close genetic connexion; but it is easily distinguished by the entire leaflets and by the much more numerous ovoid hairy carpels. In *C. japonica* the carpels are less numerous, almost or quite glabrous, elongated, and almost spindle-shaped. Moreover, if we unite *C. japonica* and *C. Prattii*, we must go further and include *C. lasiandra*, Maxim., which has carpels very similar to those of *C. Prattii* associated with usually 5-foliolate leaves.

2. **Gleditschia officinalis,** *Hemsl.* [Leguminosæ-Cæsalpinieæ]; arbor foliis pinnatis, foliolis fere rectis obscurissime crenulatis, legumine angusto 3–4 poll. longo.

*Arbor* 30–40 pedalis trunco spinis armato (A. Henry), ramulis floriferis flexuosis inermibus parce puberulis pallidis crebre lenticellatis. *Folia* ramulorum floriferorum omnia simpliciter pinnata, fere omnino glabra, cum petiolo 6–10 poll. longa; foliola 6–10, opposita, brevis-

sime petiolulata, subcoriacea, ovali-oblonga vel ovata, 1½–3½ poll. longa, et 1–2 poll. lata, obtusa, basi rotundata, supra nitida, subtus secus costam primum puberula, venis transversis numerosissimis. *Flores* ♀ laxe racemosi, racemis folia æquantibus vel brevioribus, pedicellis puberulis gracilibus quam flores paullo longioribus ; calysis lobi sæpius 4, æquales, lanceolato-oblonga vix acuta ; petala isomera, paullo longiora (circiter 4 lineas longa) obtusa; ovarium breviter stipitatum, crassum, compressum, pilosulum, multiovulatum. *Legumen* (maturum non visum) distincte stipitatum, glabrescens, glaucum vel pruinosum, compressum, marginatum, 3–4 poll. longum, 5–6 lineas latum, plus minusve curvatum, acuminatum.

*Hab.*—China : South Wushan, Szechuen, Dr. A. Henry, 5619, 7230.

A very distinct species with broad leaflets and a short narrow pod. The pod is used in medicine, and is exported from the Province of Szechuen under the name of "Ya-tsao;" and Dr. A. Henry notes that the tree scarcely occurs eastward of that province. Nevertheless it is very probable that his specimens, numbered 7771, from the neighbourhood of Ichang, are the male of this species, though the leaflets are much smaller; but it is better not to run the risk of drawing up the description from two species, therefore it has not been included in the description.

Among the Chinese drugs in the museum of the Pharmaceutical Society of London, are pods of this *Gleditschia* bearing the name cited by Dr. Henry.

3. ***Ipomæa Lesteri**, *Baker* [Convolvulaceæ] ; perennis, caule gracili volubili pilis patentibus vestito, foliis integris glabris ovato-sagittatis longe petiolatis, floribus axillaribus 1–3–nis longe pedunculatis, bracteis magnis ovatis foliaceis persistentibus, sepalis ovatis obtusis glabris minute mucronatis, corollâ magna infundibulari splendide rubra.

*Hab.*—Tropical Africa : Upper Guinea ; South bank of the Gambia river, *Dr. Brown Lester.*

*Folia* 3–5 pollicaria. Sepala pollicaria. Corollâ 3–4 pollicaria.

This very handsome new species belongs to the subgenus *Euipomæa.* It is nearly allied to *I. sagittata*, Desf. (*I. sagittifolia*, Ker in Bot. Reg. tab. 437). I find that there are no less than 120 species of Ipomæa now known in tropical Africa, a large number of which are yet unnamed and undescribed.

4. **Gaertnera morindoides**, *Baker* [Loganiaceæ] ; sarmentosa, glabra, foliis oblongis acuminatis basi cuneatis, floribus in capitulis parvis globosis aggregatis, calyce campanulato ore truncato, corollæ tubo cylindrico, segmentis lineari-oblongis tubo brevioribus, filamentis brevissimis, antheris lineari-oblongis.

*Hab.*—Tropical Africa : Upper Guinea ; Tonkah Limbah, inland from Sierra Leone, *Garrett*, 23. Native name, *Lengkelli.*

*Folia* 3–4 poll. longa. *Calyx* 1 lin. longus. *Corrollæ* tubus 3 lin. longus. *Stamina* ad tubi faucem inserta.

Easily distinguished from all the other tropical African species by its capitate inflorescence.

5. ***Cyrtanthus (Gastronema) Galpini**, *Baker* [Amaryllideæ] ; bulbo ovoideo tunicis pallidis membranaceis, foliis hysteranthiis mihi ignotis, scapo gracillimo unifloro, spathæ valvis 2 lanceolatis membranaceis, pedicello producto, perianthio splendide rubro luteo tincto, tubo basi cylindrico supra medium late infundibulari, segmentis ovatis obtusis

mucronatis tubo 2–3-plo brevioribus, staminibus biseriatis prope tubi medium insertis, antheris parvis oblongis, stylo antheris eminente ramis stigmatosis tribus magnis subulatis patulis.

*Hab.*—South Africa: Rocky hillsides, Barberton, Transvaal, alt. 3,000 feet, flowering without the leaves in August, *Galpin*, 409.

*Bulbus* 7–8 lin. diam. *Pedunculus* 3–5 pollicaris. *Spathæ* valvæ 9–12 lin. longæ, pedicello longiores. *Perianthium* 2 poll. longum, tubi ore 6–8 lin. diam.

A new species of *Cyrtanthus*, of the subgenus *Gastronema*, with bright red flowers flushed with yellow, allied to *C. sanguineus*, Hook., in Bot. Mag. t. 5218. Well worthy of being introduced into cultivation.

6. ***Aloe (Eualoe) Boylei**, *Baker* [Liliaceæ]; acaulis, foliis subcarnosis tenuibus lanceolatis acuminatis, dentibus marginalibus crebris patulis parvis deltoideis albidis, pedunculo simplici robusto, floribus pluribus in capitulum globosum aggregatis, pedicellis elongatis, bracteis magnis scariosis ovatis acuminatis, perianthio pallido tubo subnullo segmentis lanceolatis, staminibus perianthio brevioribus.

*Hab.*—South Africa: Head of the Tugela Valley, Natal; gathered by Mr. Allison. A dried specimen received from Mr. F. Boyle, April 1891.

*Folia* pedalia et ultra, 9–12 lin. lata. *Capitulum* 5 poll. diam., pedicellis $1\frac{1}{2}$–2 poll. longis, bracteis inferioribus 12–15 lin. longis. *Perianthium* 12–15 lin. longum.

Nearly allied to *A. Cooperi*, Baker (Bot. Mag. tab. 6377), from which it differs by its lanceolate leaves, ovate bracts and acute perianth-segments. Mr. Allison has also presented a living plant to Kew.

7. **Tripogon Lisboæ**, *Stapf* [Gramineæ]; gluma vacua superiore acuta nervo crasso percursa margine membranaceo angusto vel angustissimo, glumis florentibus nervo medio in aristam rectam brevem, lateralibus in mucronulos brevissimos productis.

*Perennis*, ad $2\frac{1}{2}$ ped. altus. *Folia* ligula obsoleta (an semper ?), lamina longissime attenuata, 11–15 poll. longa et basi $1\frac{1}{2}$–$2\frac{1}{2}$ lin. lata, rigida plerumque convoluta supra imprimis basin versus pilosa et vasculis scleromaticis 7–9 valde prominulis percursa. *Spica* 6–8 poll. longa, angusta. *Spiculæ* pro numero florum $2\frac{1}{2}$–$5\frac{1}{2}$ lin. longæ, primum arcte approximatæ unilaterales, demum divergentes. *Glumæ* vacuæ valde inæquales, inferior in latere intus spectante dente obtuso aucta, superior lanceolata $1\frac{1}{2}$–2 lin. longa, florentes 5–12, basi pilis brevissimis suffultæ, ovato-lanceolatæ, $1\frac{1}{2}$–$1\frac{3}{4}$ lin. longæ, arista media $\frac{1}{3}$ lin. longa, superiores 1–2 vacuæ. *Palea* bidentata in carinis superne asperula. *Caryopsis* anguste oblonga, teres, glabra.

*Hab.*—India, from Canara and Mysore to Mt. Abu: Canara and Mysore, *Law*; Bombay Presidency, *Lisboa*; on rocks near the Carley Coves, near Poonah, *Jacquemont*, 581; Rajputana, Mt. Abu, on rocks, *Duthie*, 6788.

The plant from Canara and Mysore was distributed in "Herb. Ind. Or. Hook. fil. et Thomson," under No. 5 as *Tripogon*. The specimen in the Kew Herbarium consists of 9 spikes, some of them with the uppermost leaf on the culm. They are less robust than Lisboa's or Duthie's plants, but the structure of the spikelets and flowers is quite the same.

8. **Tripogon Jacquemontii,** *Stapf* [Gramineæ]; **gluma vacua** superiore apice minutissime tridentata nervo medio tenui basi subbipartito, glumis florentibus nervo medio in aristam rectam brevem, lateralibus in mucronulos interdum fere obsoletos productis.

*Perenne*, 1–2 ped. alt. altus. *Folia* ligula brevissime ciliata, lamina convoluta subfiliformi glabra, innovationum $3\frac{1}{2}$–$5\frac{1}{2}$ poll., culmorum ad 2 poll. longa, supra vasculis scleromaticis 17–19 tenuissimis percursa *Spica* ad $5\frac{1}{2}$ poll. longa angusta. *Spiculæ* pro florum numero $4\frac{1}{2}$–13 lin. longæ, spatio eorum longitudine 2–3 plo. breviore remotæ vel interdum imprimis basin spicæ versus magis distantes, plus minusve secundæ. *Glumæ* vacuæ valde inæquales, inferior in latere intus spectante dente lato truncato aucta, superior lanceolata; florentes 10–21 basi pilis brevibus suffultæ ovato-oblongæ, apice erosæ, $1\frac{1}{2}$–2 lin. longæ, arista media $\frac{1}{3}$ lin. longa, superiores 1–3 vacuæ. *Palea* bidentata in carinis superne asperula. *Caryopsis* anguste oblonga teres glabra.

*Hab.*—India, from the Western Ghats to Bengal: Bombay Presdency, *Lisboa*, *G. M. Woodrow*, 79; Poona, *Jacquemont*, 320 bis; Sholapur, *Herb. Munro;* Bengal, *Griffith*, Kew Distr., No. 6636.

The structure of the spikelets and flowers is, apart from their larger size and usually looser disposition, very much like that of spikelets and flowers of *Tripogon Lisboæ.* The lateral nerves end in very minute bristles, which are hardly produced beyond the scabrous margin of the small terminal lobes; in the Bengal specimen, however, they are distinct, yet very short. But the leaves differ very much from those of *Tripogon Lisboæ*, especially in their anatomical structure.

*Tripogon Lisboæ* is nearest allied to *T. bromoides*, Roth., to which species *T. zeylanicus*, Nees in Stued., *T. festucoides*, Jaub. et Spach, *T. Griffithii*, Nees ex Steud,, and *T. lanatus*, Hochst. ex Steud., must be reduced as synonyms, and in a less degree to a species which has hitherto only been found in Sikkim, the Khasia Mountains, and Tonkin, and was named *Tripogon trifidus* by Munro in mss. It differs in the very robust habit, which, however, is almost reached in some of the stouter specimens of *T. trifidus*, and in the still more reduced awns, the lateral ones being almost suppressed. The same thing occurs in *T. Jacquemontii* the spikelets of which sometimes assume a rather peculiar appearance in a mature state as they fill out and resemble those of certain forms of *Eragrostis corromandeliana*, Trin. Indeed, the affinities of these Tripogons and the species of *Eragrostis* of the group of *E. corromandeliana* is very great, the difference between them almost being reduced to the shape of the caryopsis and the absence of awns or terminal lobes in the flowering glumes of *Eragrostis.* On the other hand, the two new Tripogons connect to a certain degree the group of *T. bromoides*, Roth, *trifidus* Munro mss., *filiformis*, Nees in Steud. (of which I find *T. unidentatus*, Nees in Steud. is a synonym), and *T. capillatus*, Jaub. et Spach, with the group of *T. abyssinicus*, Nees in Steud. The latter is represented in the Himalaya by a form which can hardly be considered as a distinct species, the *Catapodium filiforme*, Nees in Steud., or *Festuca filiformis*, Steud. The differences of the *Tripogon* species are taken from apparently very trifling characters, as, for instance, the development or reduction of awns. They are, however, within limited geographical areas remarkably constant, and coincide with a certain similarity in the habit which is not easy to convey in a short description.

9. **Aristida redacta,** *Stapf* [Gramineæ]; **gluma vacua inferiore plerumque sola persistente, florente parte inferiore ovarium fovente**

sub anthesi membranacea tubuloso-involuta demum chartacea, superne indurata subdilatata et sensim in aristam abeunte supra semen facile secedente sed non vere articulata, arista usque ad geniculationem contorta, hic setis brevibus vel brevissimis tenuibus aucta vel simplice.

*Annua*, interdum perennans et tunc robustior culmis inferne parce ramosis et laxius vaginatis, 1–2 ped. alta. *Folia* vaginis glabris, ligula angusta breviter denseque ciliata, lamina plus minusve setaceo-convoluta, culmorum ad 5½ poll. longa, innovationum multo breviore, sparse longeque pilosa supra et in marginibus asperula infra lævi. *Panicula* laxa, demum expansa, ad 9½ poll, longa, ad 7½ poll. lata, ramis plerumque geminatis remotis demum patulis, pedicellis inæquilongis, glumis semper brevioribus. *Glumæ* vacuæ subæquales anguste lanceolatæ subulato-acuminatæ, breviter aristatæ, 5–7 lin. longæ; florens callo piloso insidens plerumque purpurascens cum arista 13–17 lin. longa. *Aristæ* laterales setiformes, ut media scabriusculæ ½–1½, rarius ad 3 lin, longæ vel nullæ. *Palea* hyalina, oblonga, obtusa vel erosa, enervis, ovario subæquilonga. Lodiculæ 2, ovatæ vel oblongæ, 7–9 nerves, nervis tenuissimis. *Caryopsis* subcilindrica, teres, glaberrima.

*Hab.*—India, from the Western Ghats to Eastern Chuttanagpur: Bombay Presidency, *Lisboa, G. M. Woodrow;* Central Provinces: Nagpur District, *Duthie*, 10,605; Bengal Presidency, Burdwan District, near Burrakur, *C. B. Clarke*, 21,115.

This species is very remarkable on account of the occasional complete suppression at the lateral awns and the imperfect articulation in the upper part of the flowering glume. Intermediary forms may be found from awns with lateral setæ 1½–2½ lines long to awns without any. Such glumes are especially, if the articulation is more distinct, exceedingly similar to those of certain Stipas, and I was indeed first inclined to regard the present plant as a *Stipa*. But as I said the articulation is imperfect, and, as far as my investigation goes, not caused by the forming of a special tissue within which the disarticulation takes place. The tender tissue of the lower part of the glume passes more or less suddenly into a considerable thickening just above the ovary or the caryopsis, and here it is that the upper part with the awn comes off in a mature state, sometimes with a smooth sometimes with a rough margin. Besides, there are invariably only two lodiculæ, and the palea is also of the same character as in the allied species of *Aristida*, of which *A. funiculata*, Trin., is the nearest. There are a few Central American species of *Aristida* which are said to have reduced or entirely suppressed lateral awns. They were originally referred to *Streptachne* by Kunth (H. B. et K.. Nov. Gen. et Sp., I. 124, t. 40) and to the section *Chætaria* of *Aristida* by Bentham in the Gen. Plant. But as far as I can see from the material in the Kew Herbarium, the laterial awns are entirely absent in these specimens, and there is no trace of articulation, not even of the imperfect form as in *Aristida redacta*. This variation in the development of the lateral awns shows once more the comparative inconstancy of one of the very few characters upon which the distinction between *Aristida* and *Stipa* is founded. On the other hand, it is a very remarkable fact that in India both genera inhabit almost separate areas, the Stipas belonging to the Himalaya, the Punjab and Sind, representing elements of the Mediterranean and Central Asian flora, whilst the Aristidas are mostly restricted to the Deccan Peninsula and Ceylon, and only a few of them reach the Punjab and the upper Gangetic Plain, and only one is found in a limited part of the Himalaya.

10. **Gymnogramme (Selliguea) Baileyi,** *Baker* [Filices]; rhizomate gracili longe repente paleis parvis lanceolatis brunneis membranaceis

vestito, stipite gracili nudo, frondibus membranaceis glabris in stipitem longe attenuatis simplicibus lanceolatis vel oblongo-lanceolatis profunde pinnatifidis, lobis primariis 3–4 jugis ascendentibus lanceolatis integris, venis in areolas copiosas hexagonas venulis liberis inclusis anastomosantibus. soris linearibus inter costam et marginem medialibus. *Grammitis membranacea*, Bailey Synops. Queensland Flora, Supplement, iii. p. 94, non Blume.

*Hab.*—Australia : Queensland, on the Bellenden-Ker range, alt. 4,000 feet, *Bailey.*

*Stipes* 3–4 pollicaris. *Folia* simplicia 9–12 lin. lata, pinnatifida 4–5 poll. lata, pinnis 5–6 lin. latis.

This appears to be quite distinct both from the Javan *G. membranacea*, Hook., and the North Australian *G. Sayeri*, F. M. & Baker. In habit and variety of cutting it closely resembles the well-known *Polypodium scandens*, Forst.

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## CCXL.—AGRICULTURAL RESOURCES OF ZANZIBAR.

A correspondence has taken place between the Foreign Office and Kew respecting the plant industries of Zanzibar. Samples of fibre prepared from the pine-apple and other plants were received, and an estimate obtained of their commercial value.

Subsequently the Secretary of State communicated a report, in which Mr. G. H. Portal, C.B., Her Majesty's Agent and Consul-General, dealt at some length with the agricultural industries of Zanzibar generally. This report is included in an account of the trade of Zanzibar, which has been printed in the Foreign Office Reports [*Annual Series*, 1892, No. 982, Diplomatic and Consular Reports on Trade and Finance, C.—6550.—44], and is therefore not now reproduced.

During the time that Sir John Kirk was resident in Zanzibar he maintained at his own expense an experimental garden, in which he tried every useful tropical plant likely to be adapted to the climate. These were for the most part supplied from Kew. It seemed desirable to put on record, for future guidance, some account of the results of work in which Sir John Kirk took an enthusiastic interest. For this purpose he has very kindly furnished the following letter.

The importance of the subject may be measured by the fact that the plants established by Sir John Kirk's energy in Zanzibar and Pemba will always in the future be available for stocking plantations on the mainland of Eastern Africa.

### Sir John Kirk, G.C.M.G., to Royal Gardens, Kew.

Dear Thiselton-Dyer, Sevenoaks, 21st February 1892.

I have read with interest the papers you sent me for perusal on the vegetable products of the islands of Zanzibar and Pemba, now under the direct administration of British officers.

The following remarks apply only to the islands of Zanzibar and Pemba, where the climate and products differ considerably from those of the mainland in consequence of the greater variation of temperature and the absence there of rain for several months of the year.

The accompanying table, giving the results of a series of observations taken with reliable instruments throughout a series of five years, which have been corrected for index and other errors at the Observatory, Bombay, will show better than any general description the main features

of the climate of the town of Zanzibar. It is, however, well to note that if reliance is to be placed on observations taken 40 years ago, the rainfall has since then diminished to about one third of what it then was. In confirmation of this we know that there has been a gradual and marked diminution during the last 30 years.

The chief vegetable products of the islands of commercial importance at the present time are :—

The Clove (*Eugenia caryophyllata*, Thb.), first introduced into cultivation in the islands of Mauritius and Bourbon (Réunion) by the French in 1770 was taken to Zanzibar about 70 years ago, where it became an article of general attention to the Arab planters of Zanzibar and Pemba. Previous to the year 1872, when the whole of the island of Zanzibar and the southern part of Pemba were swept by a hurricane that destroyed the clove trees, the crop reached from 7,000,000 to 11,000,000 lbs. weight yearly, two thirds of which were produced by estates in Zanzibar. It is only within the last six years that the plantations of clove trees have been restored and come into full bearing again. The crop of the two islands, as shown by Mr. Portal's report, now exceeds what it was previous to the hurricane.

[An account of the Clove industry at Zanzibar is given in United States Consular Reports, April 1890, p. 687, by Consul Pratt.]

The crop next in importance to the clove is that of the Cocoa-nut Palm (*Cocos nucifera*, L.), which yields both oil and fibre. This also suffered excessively in the hurricane of 1872, before which time the value of cocoa-nuts exported amounted to nearly 200,000*l.* per annum in the form of copra, which was sent to Bombay and Marseilles or used for the manufacture of oil on the spot.

The young cocoa-nut palm in both the island of Zanzibar and on the mainland is peculiarly liable to the attack of a large rhinoceros beetle, one of the Lamellicorns, *Oryctes insularis*, Coq. The ordinary cocoa-nut palm takes eight years to come into bearing, but there is a dwarf kind that bears after five years.

Sugar-cane (*Saccharum officinarum*, L.).—Before the introduction of the clove the sugar-cane was much grown. It has since been tried on a large scale, but the climate and soil are badly suited for it, and the plant is attacked by a beetle, *Heteronychus atratus*, Klug, that bores into the cane underground, causing it to rot, and so destroying great patches in the districts so affected.

Chillies (*Capsicum annuum*, L., and *C. frutescens*, *L.*,probably).—The small red peppers or chillies are largely grown in the more dry and rocky part of the island, where the upheaved coral presents a honeycombed surface, that favours the accumulation of rich soil in the crevices, The pods are picked when ripe, sun-dried, and packed in mat bags made of the split frond of the Hyphæne palm for shipment. This is an industry that has sprung up within the last 30 years.

[Zanzibar chillies, as they appear in the market in a dry state, are small, red, thin, carrot-shaped fruits about an inch in length. They fetch in Mincing Lane public sales from 70*s.* to 140*s.* per cwt.].

Following the above vegetable products known in trade as exports from Zanzibar, come the cereals, the vegetables and fruits in common use. These are: Maize (*Zea Mays*, L.); Sorghum or Guinea corn (*Sorghum vulgare*, Pers.); Rice (*Oryza sativa*, L.); African Millet or Kous (*Pennisetum typhoideum*, Rich.); Eleusine or Kurakan (*Eleusine coracana*, Gærtn.?); Cassava (*Manihot utilissima*, Pohl.); sweet potato (*Ipomœa Batatas*, Lam.); Yams (*Dioscorea* spp.) and *Colocasia*. There is a great variety of peas and pulse, including Cajanus (*Cajanus indicus*, Spr.); The Bambarra ground-nut

(*Voandzeia subterranea*, Thouars), called "Litlo" in the Shiré valley; and the common ground-nut (*Arachis hypogæa*, L.). The chief vegetables are Pumpkin, Vegetable Marrow, Brinjal (*Solanum Melongena*, L.), and Bhamia (*Hibiscus esculentus*, L.). The common tomato grows everywhere.

The fruits are: the Mango (*Mangifera indica*, L.), introduced in old times by Arabs and everywhere cultivated. There are in the islands trees of great age and of many fine varieties. More recently new kinds have been introduced from Réunion and from Bombay, but there are few better than those already grown in Zanzibar. The *Citrus* fruits such as the Orange, Mandarin orange of two kinds, Lemon, Citron, Lime, Sweet Lime, are all common. The oranges are of the very best kind. The Pumelow or Shaddock (*Citrus decumana*, Willd.) grows well, but the fruit has not the best flavour. The Anonas, including the Custard Apple or Bullock's heart (*Anona reticulata*, L.), Sour Sop *Anona muricata*, L.), and Sweet Sop (*Anona squamosa*, L.), all grow well. The Litchi (*Nephelium Litchi*, Don), introduced about the same time as the clove, grows well. The Rambutan (*Nephelium lappaceum*, L.), is thriving. The Avocado pear (*Persea gratissima*, Gærtn.) was introduced quite recently; it grows well. Guava (*Psidium Guayava*, Raddi), the common guava, grows everywhere; there are also two other species lately introduced. The Rose Apple (*Eugenia Jambos*, L.), the Jambosa (*Eugenia Jambolana*), and Zimberao (? *Eugenia malaccensis*, L.), are all grown by the Arabs, the last has become almost wild.

Durian (*Durio Zibethinus*, D.C.), is found only on a few estates, but grows and yields well.

Jack fruit (*Artocarpus integrifolia*, L.), is found everywhere in the islands, and much eaten by natives. The wood also is valuable, being almost the only native timber soft enough to be easily worked.

Bread fruit (*Artocarpus incisa*, L.). Only a few trees of this are to be found in the islands.

Mulberry (*Morus indica*, L.). The species grown is the small Indian black mulberry. The bush is seen everywhere, being used to mark boundaries between estates. A twig pushed into the ground takes root so readily that it is used for this purpose along with *Jatropha Curcas*.

Mangosteen (*Garcinia Mangostana*, L.). This has been introduced, but although there are trees of some size they have not yet flowered.

The Vine (*Vitis vinifera*, L.). The grape vine yields poorly, the climate being too hot. The Arabs obtain a crop by beating the leaves off so as to produce a time of rest to the plant.

Date Palm (*Phœnix dactylifera*, L.). The date grows, but the fruit is worthless.

Papaw (*Carica Papaya*, L.) grows everywhere, especially in rocky ground and among rubbish. The seeds are used by the slave women to bring on abortion.

Pine Apple (*Ananas sativus*, Baker). The common pine of Zanzibar is big and rather coarse from careless cultivation. It becomes almost wild, when it produces large leaves that have been used to yield fibre. This, however, has never been an article of trade in the islands.

Passion-fruit. The large Granadilla (*Passiflora macrocarpa*, Mast.) grows profusely wherever it has been planted, but is not valued.

The following are the chief oil seeds now in use:—

*Arachis hypogæa*, L., the ground nut, is more grown on the mainland than in the islands.

*Sesamum indicum*, L., known locally as Sim-sim.—This also is extensively cultivated, but chiefly on the mainland. There are two kinds, the white and the black. The common castor oil plant (*Ricinus communis*, L.) is found in every village, and the seed used for oil.

A Cucurbit (*Telfairia occidentalis*, Hk. f.) is a native of the island and also of the mainland; the seeds are roasted and eaten; oil also is prepared from them.

The oil palm (*Elæis guineensis*, Jacq.). The oil palm occurs in Zanzibar wild, but is abundant in Pemba. The kernal is exported, but the husk yields very little oil. The species requires verification.

[Specimens of oil-palm from Zanzibar, believed by Sir John Kirk to be identical with that found in Central Africa by himself on Lake Nyassa, and by Captain Burton on Tanganyika, were received at Kew in 1868.]

The following are the chief fibres:—

Cordage is made from the coir of the cocoa-nut and exported.

Cotton. Cloth is made of the native cotton (*Gossypium*, spp.) which grows readily, but the bole is very subject to be attacked by insects, and the occurrence of rain when the crop is ready to pick makes cotton a crop ill suited to the islands although eminently so to the mainland.

*Furcræa gigantea*, Vent., known as Mauritius hemp, and another species introduced from Mauritius, both yield fibre. The plants grow well. [For an account of Mauritius hemp see *Kew Bulletin*, 1887, March, p. 8.]

The common American aloe (*Agave americana*, L.) has been introduced, but does not spread like the *Furcræa*. The species of *Sansevieria* common in the islands is worthless, being too short in the fibre. Other species on the mainland yield excellent fibre. [*Kew Bulletin*, May 1887.]

Dyes. Indigo is perhaps the only vegetable dye that has been manufactured for export in the islands. The industry has been abandoned for near 40 years, and the tanks have gone to ruin. The plant grows wild everywhere.

*Orchella-weed* (probably derived fron one or more species of *Roccella*.) This is obtainable in Zanzibar, but the supply for trade is all derived from the northern coast of the mainland.

Logwood (*Hæmatoxylon campechianum*, L.) has been introduced. and spreads rapidly, being evidently well adapted to the climate and soil.

Coffee. Arabian coffee (*Coffea arabica*, L.) is grown by the Arabs, but yields badly, the plant is also peculiarly liable to be killed suddenly by the attack of a beetle that bores down the pith to the root.

Liberian Coffee (*Coffee liberica*, Hiern) has been introduced, grows well, and yields freely, the coffee being of excellent quality.

Areca nut (*Areca Catechu*, L.).—The Betel palm grows and supplies not only the local demand, but also a certain amount for export. Betel pepper (*Piper Betle*, L.) is grown for its leaf in places artificially watered and shaded. The leaf is sold in every village. Vanilla (*Vanilla planifolia*, And.) was introduced from Réunion; it grows badly in Zanzibar, but might no doubt do better in the island of Pemba, where the rainfall is supposed to be greater. Is is however, a plant requiring too much delicate manipulation to suit the natives. Pimento (*Pimenta officinalis*, Ldl.).—This was introduced and grows well as far as I have had experience. Cinnamon (*Cinnamomum zeylanicum*, Nees), and Nutmeg (*Myristica fragrans*, Houtt.) were introduced almost 70 years ago; both grow still in many places: but no attention is paid to their cultivation. Chinese Cassia (*Cinnamomum Cassia*, Bl.) has recently been introduced and seemed to promise well.

Cacao (*Theobroma Cacao*, L.).—This has been grown, but the soil of the islands is in general too light, and the air too dry for the crop to succeed. Tea (*Camellia theifera*, Griff.).—This does not thrive and will never be a product of the island of Zanzibar; it has not been yet tried in Pemba. In addition to the above a host of other plants have been introduced from Kew to the experimental garden established by me at Mbweni, amongst which are the Mahogany (*Swietenia Mahagoni*, L.) which grows well; the Ceara rubber (*Manihot Glaziovii*, Mull. Arg.), which spreads everywhere, but yields little juice; the Para rubber (*Hevea brasiliensis*, Mull. Arg.), which grows well, but had not flowered; the Brazil nut (*Bertholletia excelsa*, Humb.), which grows and was forming a good stem, although it will be several years before it can bear fruit.

The Jujube tree (*Zizyphus Jujuba*, Lam.) has been introduced from India and grows well. The Annatto plant (*Bixa Orellana*, L.) is very common about Arab gardens. The Henna plant (*Lawsonia inermis*, L.) grows freely and is almost naturalised. The Cashew nut (*Anacardium occidentale*, L.) is in all Arab gardens. The common fig (*Ficus Carica*, L.) is commonly cultivated for the fruit which, however, is poor.

[Mr. Portal states that "sago palms grow with apparent health and "luxuriance, but their cultivation on a large scale has never been "attempted." There are apparently no true sago palms (species of *Metroxylon*) in Zanzibar. The plants mentioned by Mr. Portal may be species of *Encephalartos* or other Cycads. These contain a kind of sago in the pith of the stem, and hence are sometimes called "sago palms."]

MEANS of METEOROLOGICAL OBSERVATIONS (reduced to sea-level) taken in the Town of ZANZIBAR in the five years 1880 to 1884, inclusive.

| Month. | Mean Maximum. | Mean Minimum. | Approximate mean Temperature. | Extreme Range. | Barometer (reduced to sea-level and Temperature 32°). | Humidity. | | Rainfall. | Number of Days on which rain fell. | Month. |
|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | 10 a.m. | 4 p.m. | | | |
| January - | 85·4 | 77·7 | 81· | 13·6 | 29·899 | 79 | 67 | 2·77 | 7 | January. |
| February - | 85·9 | 78· | 81·4 | 14·4 | 29·893 | 79 | 68 | 5·27 | 9 | February. |
| March - | 86·9 | 78·8 | 82·3 | 13·8 | 29·888 | 79 | 67 | 3·95 | 7 | March. |
| April - | 84·9 | 77·4 | 80·5 | 16·1 | 29·929 | 80 | 75 | 10·24 | 18 | April. |
| May - | 82·7 | 75·4 | 78·2 | 14·4 | 29·995 | 83 | 74 | 10·12 | 17 | May. |
| June - | 83·8 | 74·5 | 77·9 | 12·4 | 30·085 | 77 | 60 | 0·31 | 3 | June. |
| July - | 81·7 | 73·2 | 76·4 | 13·1 | 30·103 | 77 | 60 | 2·03 | 6 | July. |
| August - | 82·3 | 72·5 | 76·4 | 14·2 | 30·386 | 75 | 57 | 1·19 | 7 | August. |
| September | 83·5 | 73·8 | 77·6 | 13·4 | 30·078 | 76 | 61 | 1·12 | 7 | September. |
| October - | 83·9 | 74·9 | 78·7 | 14·4 | 30·006 | 78 | 63 | 2·52 | 11 | October. |
| November | 84·6 | 76·4 | 80·4 | 14·1 | 29·924 | 78 | 68 | 5·00 | 14 | November. |
| December - | 85·4 | 77·4 | 80·8 | 13·2 | 29·923 | 79 | 67 | 4·35 | 12 | December. |
| | | | | | | Total - | | 48·87 | 118 | |

Mean temperature = 79°·3.
Highest temperature recorded = 91°·2 in February 1882; lowest = 67°·4 in September 1884.

## CCXLI.—BOTANICAL STATION, ST. VINCENT.

Amongst the botanical stations lately started in the West Indies (in accordance with a scheme described in the *Kew Bulletin*, June and July 1887) there is none invested with so much interest as the station now in course of being established in the island of St. Vincent.

St. Vincent is one of the Windward Islands lying about 100 miles westerly of Barbados. It is a picturesque and fertile island, and very healthy. There are lofty hills in the centre covered with forests, and from these numerous less elevated ridges diverge towards the sea, intersected by deep ravines. The total area is 133 square miles, with a population of 50,000. At present only about one-sixth of the surface of the island is under permanent cultivation.*

Briefly stated the object sought by the establishment of a botanical station in St. Vincent is to provide a small but efficient centre for propagating and distributing industrial plants, and to afford aid and information in regard to their cultivation in suitable localities in the island. The site of the botanical station is that occupied by the old botanical garden of St. Vincent, begun so long ago as 1765. This was the first institution of the kind started in the West Indies and possibly in any part of the new world. There are several very old botanical establishments in the West Indies. The Jamaica Botanic Garden at Bath was established about 1774, and the botanic garden at St. Pierre, Martinique, according to the *Annuaire de la Martinique*, 1884 was established "*30 pluviôse an xi. (19 fevrier 1803)*." Anderson, in one of his letters from St. Vincent, dated 20 November 1786, refers to the "French King's Garden at Cayenne" (French Guiana). The Trinidad Botanic Garden appears to have been established a little before or about the time of the removal of some of the plants in the St. Vincent garden to Trinidad in May 1823. The present attempt to establish a botanical station at St. Vincent is owing to the enterprising and well directed efforts of the present Governor-in-Chief of the Windward Islands, the Hon. Sir Walter Hely Hutchinson, K.C.M.G. In the address of his Excellency to the Legislative Council of St. Vincent, dated the 27th May 1890, he said :—

"In the meanwhile, whilst not losing sight of the claims of sugar, I have felt it my duty to encourage and assist, by every means in my power, the introduction and improvement of other industries. To this end I have addressed to the Director of the Royal Gardens at Kew a series of inquiries as to the cultivation and manufacture of arrowroot, the replies to which may, I trust, lead to an improvement of the quality and price of that article as manufactured in St. Vincent, and I have asked you to provide for the re-establishment of the old botanic garden here, in order that we may have at our command the services of a scientifically trained botanist and horticulturist, whose duty it will be to conduct, in connexion with the establishment at Kew, experiments with economic plants, to supply, at cost price, plants, seedlings, and seeds of economic plants to persons who desire to cultivate them, and to give to landowners, large and small, such information as he may possess or can obtain and they may require, either with regard to the cultivation

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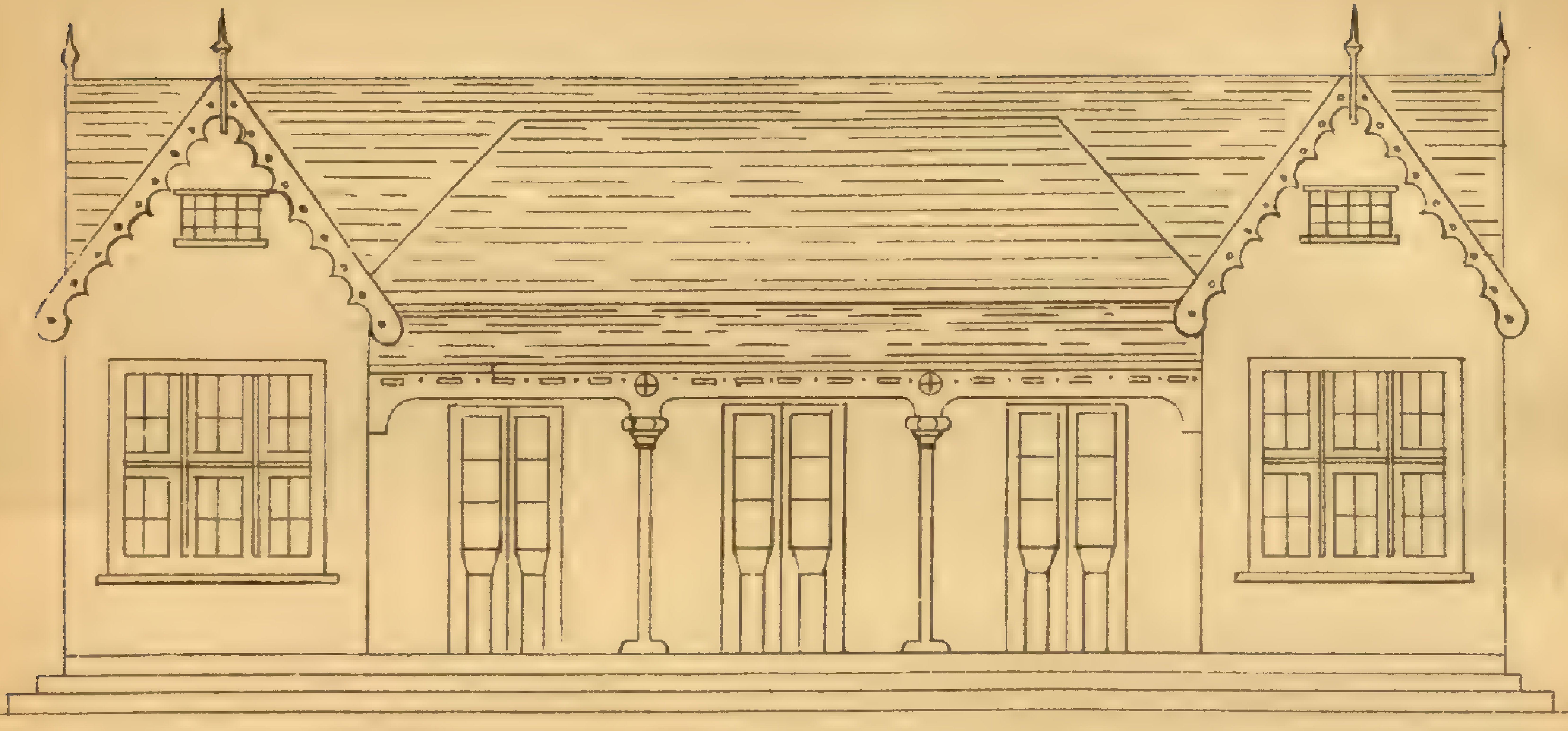
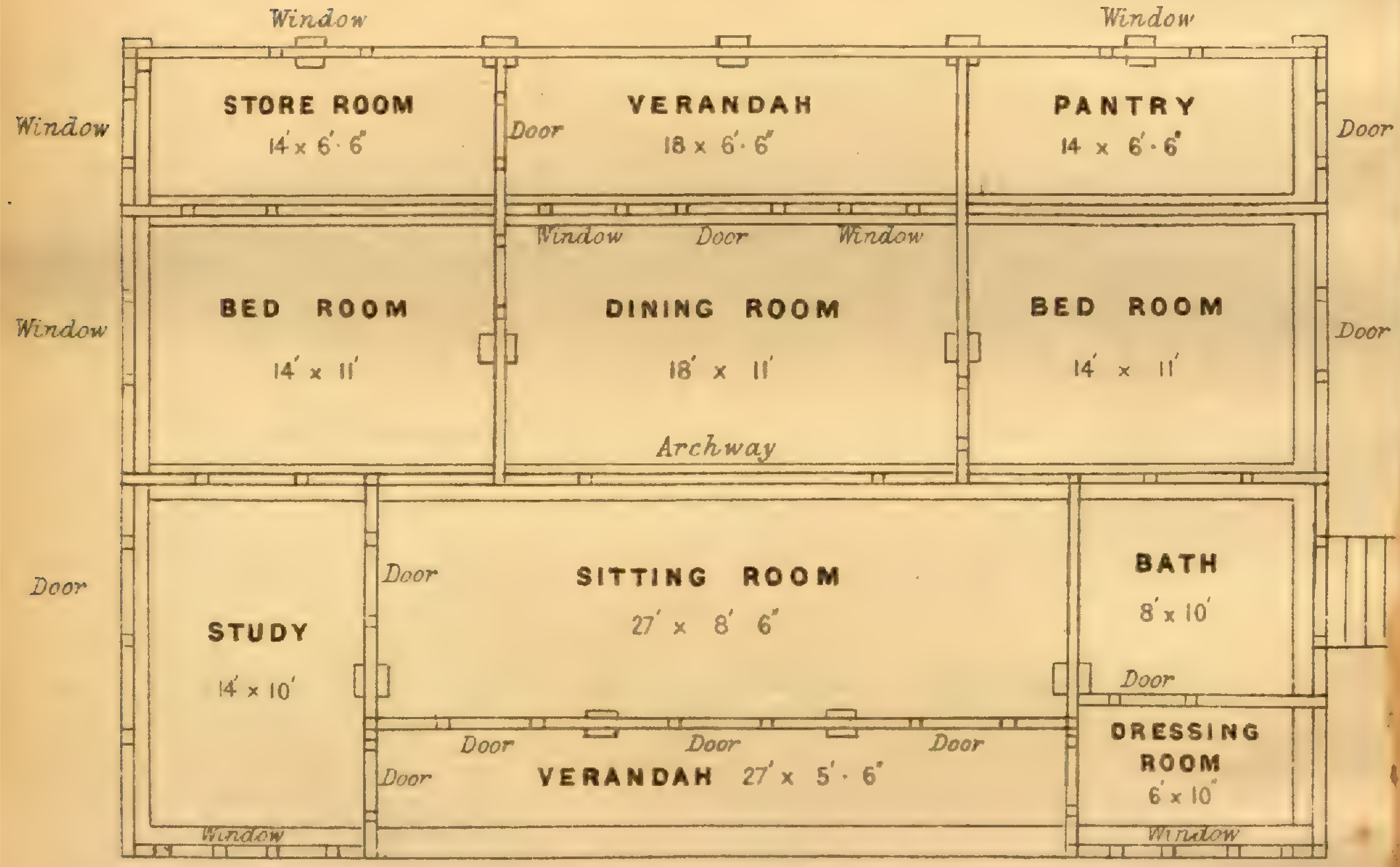
* An account of the fruits of St. Vincent is given in the *Kew Bulletin*, 1888, p. 187. A sketch of the island and its productions, with suggestions for establishing the botanical station, are given in the report of Mr. Morris' mission to the West Indies, *Kew Bulletin*, 1891, pp. 140–145.



Elevation.

## CURATOR'S HOUSE _ BOTANICAL STATION, ST VINCENT.




Plan.

Judd & Co Ltd, Lith. 63, Carter Lane, Doctors' Commons. 3329. 2

of the plants, with regard to the extirpation of parasites and diseases to which the plants may be liable, or with reference to the preparation and disposal of the economic products. A small botanical library will gradually be formed, which will be available for reference, and it is my intention that a periodical *Bulletin* be issued containing such information, or pointing out where it may be gained, as may be of assistance in developing the agricultural resources of the island.

"The Curator of the botanic garden, Mr. H. Powell, arrived by the last mail [14th May, 1890], and the regulations for the management of the garden, and prescribing the duties of the Curator, will shortly be published."

Mr. Henry Powell, the first Curator of the St. Vincent botanical station, had been trained at Kew, and had previously worked in the gardens at Goodrich Court near Ross. In addition to his horticultural training he held certificates for attendance at lectures in scientific subjects at Kew. The results of Mr. Powell's efforts will be given later.

The history of the old botanic garden of St. Vincent is well preserved. The most complete account of the institution is given by the Rev. Lansdown Guilding, B.A., F.L.S., who resided for many years in the island, and who was well acquainted with its fauna and flora. Mr. Guilding's botanical collections are in the Kew Herbarium, and they have been utilised in the preparation of the *Flora of the British West India Islands* (one of the series of Colonial Floras organised at Kew under the direction of the late Sir William Hooker), by Dr. A. H. R. Grisebach, in 1864. Mr. Guilding's account of the St. Vincent Garden, published in 1825, is a quarto pamphlet with four coloured plates, dedicated to Sir William Hooker when Regius Professor of Botany at Glasgow.*

The coloured plates consist of: (1) a view of the house of the Superintendent; (2) a view of the garden looking from the Superintendent's house in the direction of Kingstown; (3) a view in the garden from the bottom of the centre walk or avenue; (4) a diagram of the garden showing the original land and the additions made a few years later, making altogether 39½ acres.†

The situation of the garden was a sheltered rich valley, with a perennial stream running through it. It was less than a mile distant from Kingstown, the capital, and it was well adapted in every way for the purposes of cultivation. As Mr. Guilding's work is now scarce, the following extracts are taken from it descriptive of the St. Vincent Garden from its establishment in 1765, until 1825, a period of 60 years:—

"This garden seems to owe its origin to certain advertisements in the *Transactions of the Society of Arts* for 1762 and the four following years, offering rewards to any one who should cultivate a spot in the West Indies in which plants, useful in medicine and profitable as articles of commerce, might be propagated, and where nurseries of the valuable productions of Asia and other distant parts might be formed for the benefit of his Majesty's colonies.

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* An account of the botanical garden in the island of St. Vincent, by the Rev. Lansdown Guilding, B.A., F.L.S., with four coloured plates. Glasgow, Richard Griffin & Co., 1825.

† Wm. Mavor, in a History of the Discovery and Settlement of North and South America and West Indies, 1812, appears to have referred particularly to the St. Vincent Botanic Garden, but this work is not at Kew.

"General Melville, who was then Chief Governor of the ceded islands, while he resided in St. Vincent, with a laudable and patriotic zeal, resolved to commence the task; and in 1765 gave, and cleared at his own expense, 20 acres of land in the most favourable situation he could find, about half a mile distant, in a northerly direction from Kingstown, and abundantly supplied with water. To this, in 1766, another portion of ground was added. . . . . Dr. George Young, Surgeon to the Forces, the principal Medical Officer stationed in the island, was first intrusted with the charge of the ground, which he held for many years. In 1774, the doctor made a report of his progress to the Society of Arts, which they were pleased to reward with a present of 50 guineas. In the troubled times which succeeded, the garden was much neglected and injured, but was again restored in 1785, and somewhat increased, by Alexander Anderson, Esq., Surgeon, who was shortly afterwards appointed its Superintendent.

"At this period the institution was taken under the protection of Government, who supported it with great liberality till it was presented to the colony in 1822. In 1792 it was increased, but it suffered in some degree during our contest with the French and Caribs. Mr. Anderson, with great pains, collected all the most remarkable of the native plants, and in his excursions to other islands obtained many curious species. In his travels over our own mountains, in 1784, he discovered the crater of Morne Soufriére. . . .

"About 1787, the Clove, and several varieties of Cinnamon, were introduced from the French islands, to which they had been brought by their ships from Asia. The Clove, shortly after this period, was cultivated zealously in Dominique (San Domingo). In Jamaica the Cinnamon was planted on a large scale in many parts of that extensive colony.

"Books of great value, which had any reference to the plants likely to be cultivated, were now sent out by his Majesty, who was pleased to patronise the garden, and felt much concern for its prosperity. Mr. Anderson, in 1791, sailed to Guiana in search of valuable plants, where his zeal was amply rewarded. He now received from one of the universities of Scotland the degree of M.D., and was elected a fellow of the Royal Society of Edinburgh. Pleased with his incessant attention and useful labours for the benefit of the public, the Society of Arts presented him with their silver medal, elected him a corresponding member (1798), and gave him many other tokens of their approbation, while they published from time to time the communications made to them on the progress of his labours.

"Every exertion was made, as well by private individuals as by the authorities in England, to render his Majesty's Botanic Garden of St. Vincent the source from which valuable plants might be spread over the adjacent islands. Trials were made to introduce plantations of Cactus Coccinellifer [*Opuntia* (Nopalea) *coccinellifera*, Mill.], and to propagate the Cochineal insect. Many valuable seeds from Asia were sent here by the Board of Trade: at a subsequent period others were forwarded by the Board of Agriculture. A considerable number were procured from correspondents in North America, almost all of which are now flourishing and dispersed over our colonies.

"The Superintendent's salary was first fixed by Government at 7*s.* 6*d.* a day. It was afterward increased to 10*s.*, and at a subsequent period to 1*l.*, which, with rations, enabled him to live in comfort and respectability. No proper dwelling had been provided till 1798–9, when Sir George Young, Bart., a warm and zealous friend to this establishment, procured an order that a comfortable and convenient house should

be erected; in 1804 and 1808 it underwent some trifling repairs, but is now in a most ruinous condition from neglect, so rapid is the destruction of buildings within the tropics from the effects of heavy rains and the attacks of the termites [wood ants].

"So great was the interest taken in this garden, which promised to be a source of much profit to the colonies, and of commerce to the mother country, that his Majesty was pleased, in 1790, to send a ship to the South Seas to procure for it the bread-fruit (*Artocarpus incisa*) and every other valuable tree that could be obtained. The lamentable termination of this first voyage is known to everyone. . . .

"Not discouraged by the fate of the first, the King determined to fit out a second ship of discovery, and shortly afterwards Captain Bligh set sail in the 'Providence' . . .

"In December 1792 Captain Bligh touched at St. Helena on his return, and in January 1793 attended by Captain Portlock of the 'Assistant' brig, landed the best portion of his valuable cargo, about 530 plants, on the shores of St. Vincent. The young trees, which were as vigorous as if they had only travelled from our mountains, instead of having crossed a wide and troubled ocean, were instantly planted out, and after a proper interval distributed among the colonies. Having performed this duty, Captain Bligh proceeded to Jamaica, where another portion was delivered, and with the remainder (destined for his Majesty's gardens at Kew) set sail for Europe.

"The total number of plants delivered amounted to 1,217: besides, there were 700 reserved for Kew. In 1794 the bread-fruit began to bear.

"In 1798 a catalogue was made of all the plants within the garden area, conveniently arranged; and another was published by the Society of Arts in the 25th volume of their transactions.

"In 1803, 10 acres were taken from the adjoining Crown lands, commonly called the Barrack land, and added to the garden.

"Mr. Lochead, who afterwards succeeded Dr. Anderson, had obtained from Cayenne several *Nutmegs** and other plants which he had nursed in Trinidad with the greatest care. These, in 1809, were introduced by Captain Dix of his Majesty's sloop 'Cygnet,' who readily undertook the charge of them by permission of Admiral Cochrane, who then commanded on the station. These trees have borne well for many years, and considerable nurseries are established both here and in Trinidad. Even our young plants of both sexes have this year produced their flowers in great abundance.

"Worn out with toil, the venerable Anderson began to decline, and in July 1811 resigned the garden to his estimable friend and fellow-labourer William Lochead, Esq., M.W.S. Edinburgh. In 1812 this gentleman was confirmed in office but shortly afterwards suspended by the Governor. In October 1813 he was restored to his charge by an order from the authorities in England.

"On the 8th of September 1811 the virtuous Anderson was numbered with the dead."

Anderson appears to have kept up a close correspondence from 1775 to 1795, with William Forsyth, Senior, who was Curator of the Chelsea Garden in 1769, and afterwards Royal Gardener at Kensington and

* Dr. Anderson, however, had the honour of introducing the nutmeg into St. Vincent, as appears from his two letters inserted in the 21st and 22nd volumes of the *Transactions of the Society of Arts*

St. James's palaces until his death in 1804. Anderson's correspondence passed into the hands of Forsyth's executor, by whom it was given to Dr. Robert Hogg, F.L.S., about fifty years ago. It has lately been presented by Dr. Hogg to Kew. This correspondence has been rather fully printed with notes in the eighth volume of the *Cottage Gardener* (now better know as the *Journal of Horticulture*).

The early letters are addressed from New York and Philadelphia, where Anderson was apparently stationed as surgeon with the British troops. He was afterwards transferred to the West Indies and wrote interesting letters, sending home parcels of seeds and plants, from Martinique, St. Lucia, Grenada, and St. Vincent. At the latter place, he describes his position as hospital mate. In 1785, he was appointed to the charge of the Botanic Garden but his position at first was one of some difficulty. On the 1st June 1785, he writes,—" I am at present " disagreeably situate with Governor Lincoln opposing me by every " means in his power. He wishes to oppose the appointment, and to " appropriate the ground and house to his own use. He seems to pay " no attention to the instructions Sir George Young sent me. The land " [of the Botanic Garden] is a common grass piece for his cattle and " gangs of negroes traversing it every moment."

In May 1786, he writes,—" You cannot conceive the trouble and " anxiety I have experienced since I had charge of this place . . . " I have [now] above seven acres in good order and am at present " clearing about two acres more, on a cool and elevated situation, for " extra-tropical plants."

Again in November of the same year,—" I have got an artilleryman " as a gardener, and I shall soon make excursions among the islands " . . . . . . . . We have had great doings in St. Vincent for " these ten days by H.R.H. Prince William Henry [afterwards King " William IV.] paying us a visit. He honoured the garden with a visit " and was much pleased with it."

In a letter to Dr. Young, the former Superintendent living in England, dated May 4, 1787, Anderson gives the following hints respecting sending seeds to the tropics : " If the seeds were thrown into " a box with earth, even among the roots of other plants, they would " come up [germinate] during the voyage, and I should receive them " in great perfection. From reserving the earth in the boxes which I " have received with plants, I have obtained many seedlings. In this " manner I obtained from Philadelphia the paper mulberry and the " golden rod, and this year from England, the common dock, the chick- " weed, the crowfoot, *Euphorbia*, and others . . . . . . . . .

Further on he asks, " Is there any particular time or mode in drying " the senna leaves? I have some fine thriving plants of the " Alexandrina senna, from seeds sent me by Sir Joseph Banks." This senna plant became afterwards naturalised in Jamaica on the Palisadoes, and no doubt it may have spread to other parts of the West Indies.

Anderson acknowledges the receipt on May 2nd, 1789, of a parcel of plants sent by Mr. Aiton of Kew. Amongst them were the Jalap and Ginseng, both however, he says, " had perished on the voyage and were a great loss to me."

The arrival of the bread-fruit plants in the " Providence," was a great event to Anderson. He writes, February 17, 1793: " You no " doubt before this have heard of the arrival of the Bread-fruit ship " (Captain Bligh), and a beautiful cargo he brought. He is a man of " great ability, and certainly merits much. His arrival was some

"months sooner than I expected, and therefore you may conceive, "I was, and still am, much hurried. Here are about 300 Bread-fruit "plants thriving, with the other Otaheite fruits and useful plants, and "several from Timor and other parts. I sent on board above 400 "different species [from the St. Vincent Garden] for Kew, and had I "expected the ship so soon, many more would have been ready. She "remained here only seven days, and the confusion to me was so great "in landing and shipping such a number of plants, that it was almost "too much for me." Anderson, as indeed all others who knew him, appears to have entertained a warm regard for General Melville, who originated the St. Vincent Garden, and generously gave the land for it. He returns to the subject, July 23, 1794. "I send you "specimens, one of which I think is a new genus. I wish to name it "after my worthy friend, General Melville as some acknowledgment "is certainly due to him from this garden. He first founded it, and its "interests he has constantly had at heart. You will also find a drawing "of it. Pray give me your opinion of it as soon as you can . . . . "I found it on an island in the River Essequibo [British Guiana]. If "you find it new, please publish it in your Society's (Journal), as I "wish to pay a compliment to the General before he dies."

The plant above mentioned was *Melvilla speciosa*, Anders., described in the *Journal of Arts and Sciences*. It was afterwards figured and described in the *Botanical Register*, pl. 852, as *Cuphea Melvilla*, Ldl. It is now known under the latter name.

During the disturbed period of the war with the French and the Caribs, St. Vincent was often in a very precarious condition. Anderson (May 13, 1795), after describing his garden:—"this spot is very beautiful and would be much admired in England," writes, "the "garden is yet safe and flourishing; during the day I remain in it at "the risk of my life, but I am obliged to fly to the fort during the "night. I am determined to preserve it to the last extremity." Anderson's correspondence with Forsyth appears to have ceased about this time (1795). He survived, however, the troubles of the war, and in 1802, seven years later, wrote several very interesting letters descriptive of the work carried on in the garden, two of which, quoted from the *Transactions of the Society of Arts*, are given in full in Guilding's book. These were practically his last official communications.

Mr. Guilding's account continues:—

"Mr. Lochead did not long remain in the enjoyment of his situation; on the 22nd of March 1815 he joined his much lamented predecessor. His remains were deposited under one of the trees of the garden, a little above his dwelling-house, and covered by a neat and simple tablet. His widow, assisted by Mr. Billinghurst, was allowed to remain with the usual salary for nearly a year and a half, and the duties were performed by Mr. Herbert, an ingenious man, well qualified for the task.

"It now became necessary that a successor should be appointed. Through the interest of Sir Joseph Banks, Mr. George Caley and his assistant, Mr. McCray, were sent to take charge of the establishment, and arrived on the 1st of August 1816. The former gentleman had spent many years of his life in the forests of Australasia, and had brought home an abundant harvest from a field in which Brown and other celebrated travellers had already gleaned. His animals were purchased by the Linnæan Society, and are placed in the museum of that learned body. It is to be regretted that his services in the West Indies

have not been equally valuable. His residence at the garden had been made distressing from beginning to end, by continued and malicious trespasses, the violent assaults of strangers, and the encroachments of the neighbouring planters. Though much credit is due to him for the stern and inflexible honesty with which he defended the rights of the garden, it is yet much to be wished that a more liberal indulgence had been given to those who wished to visit this enchanting spot.

"In 1821 the Government, wearied probably by the constant complaints that had been made, determined on giving up the garden, which for so many years had been maintained at a great expense to the mother country, exceeding even of late the yearly sum of 700*l.* sterling. This step did not fail to cause great surprise. The nutmeg and other valuable spices had arrived at maturity; the cloves were producing annually a million of seed; and the garden, which had hitherto been comparatively of little use, was about to realise the hopes that had been entertained by its royal patron. Had a small guard from the neighbouring garrison done duty near the house, which might have been ordered without difficulty, the Superintendent might have been protected in the discharge of his duties, and the grounds have flourished as in the days of Anderson.

"The custody of the garden was resigned by Mr. Caley, December 24th, 1822, who returned to England in the month of May. The great seal was attached to the grant on the day the garden was given up by the Superintendent, and Mr. Herbert, with a small party of labourers, was appointed by the Governor to cultivate the land. The disappointment felt at its abandonment by the Crown has been fortunately dispelled by the choice of the Colonial Superintendent, under whose eye the establishment is in a very prosperous condition. Every facility is afforded by this obliging man for satisfying the curiosity of visitors, and seeds and plants are distributed on a proper application to the Governor.

"The extent of the garden, which is of irregular figure, does not exceed 39½ acres.

"The higher and hilly parts are a dense forest of useful woods, fruits, and palms, the bottom is the only part which has the least resemblance to the formal arrangement of an European garden. Here nature is unconfined, and this beautiful wilderness is without doubt the most charming residence of Flora in all her domains. A noble avenue, interrupted only by a single towering palm (*Areca Catechu*) runs from the house to the bottom, giving a view of the bay, the town, and a group of smaller islands within the government. A narrow walk leads the stranger round the bounds of this tropical nursery, and at the bottom affords a sight of the bold blue outline of the noble mountain which terminates the landscape.

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"The higher division, crowded with trees of larger growth, is perhaps most calculated to interest the European visitor. If he derives any pleasure from the beauties of picturesque scenery, on entering the silence of this solitude, he will be scarcely able to define what most excites his admiration, the individual beauty and contrast of forms, or that eternal spring and luxuriance of vegetable life which reigns around. Nature here appears prodigal of organic matter. The ground seems overloaded with plants, which have barely room enough for their development. The trunks of the older trees are everywhere covered with a thick drapery of ferns, mosses, and orchideous plants, which diffuse into the air the richest odours, and almost conceal from sight the noble plant

that upholds them. . . . Several rivulets of the purest water urge their meandering course through the brushwood; various plants of humbler growth, which love humidity, display their beautiful verdure on their edges, and are sheltered by the wide spreading arms of the Mango (*Mangifera indica*), Mahogany (*Sweitenia Mahagoni*), Teak (*Tectona grandis*), *Mimosæ* (*M. Lebbek, nilotica, Ca techu, &c.*), and other woods remarkable for their stateliness, and clothed in wild and magnificent pomp. The vegetation everywhere displays that vigorous aspect and brightness of colour so characteristic of the tropics. . . . In crevices of rocks the succulent species are [almost] daily renewed, and prepare a soil for larger tenants; from their summits the old man's beard, the *Rhipsalis* (*R. Cassytha*, Hook.),* and similar weeds, which seem to draw their nourishment from the air, hang pendant, floating like tattered drapery at the pleasure of the winds. . . . Above the rocky summit of the hill the arborescent ferns (*Cyathea aspera ?, arborea, &c.*), the principal ornaments of our scenery, appear at intervals. Convolvuli and other creepers have climbed their high stems and suspended their painted garlands. The fruits of our country are scattered around within our reach, and the wide green leaves of the *Musa* (*M. paradisaica* and *sapientum*) and *Heliconiæ* (*H. caribæa, Bihai*) planted beneath, serve to contain them for our refreshment, and to convey water from the neighbouring spring. On every side innumerable palms of various genera, whose leaves curl like plumes, shoot up majestically their bare and even columns above the wood. The portion below the house of the Superintendent has been devoted to the reception of the spices, the medicinal, and other more useful plants, which are placed in situations most favourable to their growth, rather than with a view to scientific order. In the same group are seen the precious nutmeg (*Myristica fragrans*), exposing in the centre of its bursting drupe the seed surrounded by the crimson mace; the *Cassia* (*C. fistula*) with its pendant pods of curious length; the magnificent *Lagerstrœmia* (*L. reginæ*) displaying one extended sheet of lovely blossoms; the cannon-ball tree, with its sweet and painted blossoms, scattering its fetid fruit, so much resembling the fatal shell, that one might suppose a company of artillery had bivouacked in its shade. The Calabash (*Crescentia Cujete*), with its large green pericarp, so useful in the poor man's hut, and the screw pine (*Pandanus odoratissimus*), with its fruit carved in rude and curious workmanship, and its ribbed stem supported on a bundle of faggots. Assembled together are the various fruits transplanted from the islands of Asia and other distant lands, or the woods of the Antilles, attracting, by their nectared flowers, the gaudy humming-birds. You behold the bread fruit (*Artocarpus incisa*) of the Friendly Islands, the most precious gift of Pomona, and the Jack of India (*A. integrifolia*), bearing its ponderous fruit of the weight of 60 or 70 lbs. on the trunk and arms. Here, too, a stunted Cork tree (*Quercus Suber*), and a small European oak (*Q. Robur*), sadly contrast their sickly forms with the proud offspring of the tropics. The Vanilla, with its long suckers, the Black pepper (*Piper nigrum*) of Asia, hang suspended on the boughs; the gaudy blossoms of the *Passiflora* and the long tubes of the *Solandra* (*S. grandiflora*) appear amidst the wood, mingling their blossoms with those of the neighbouring trees in wild confusion; while, at intervals, the *Agave* (*A. vivipara*) throws up its princely column of inflorescence from a

[* The plant generally known as the Old Man's Beard of the West Indies is *Tillandsia usneoides*, L.]

host of spears. Innumerable Cacti and Euphorbiæ covered with fruits or flowers, differing in the articulations of their stems, the number of their ribs, and the disposition of their spiculæ, give variety to the scene. At every step plants remarkable for their beauty or fragrance ornament your path. But I should tire the reader by continuing to enumerate the vegetable wonders of this paradise. In proper beds prepared for them we meet with the useful herbaceous species or the vegetables with which our tables are supplied. By the side of every rivulet rise large clusters of the Bamboo (*Bambusa arundinacea*), without a doubt the most generally useful of our plants. Nothing can exceed the beauty of this arborescent grass, which rises to the height of 60 or 80 feet, waving its light and graceful foliage at every breath of the winds. The *Cycas* (*C. revoluta*), and several kindred plants, so valuable for its nutritious fecula, are scattered about, attaining their greatest height in spots where nothing is allowed to impede their free development.*

"St. Vincent's, December 14, 1824."

The botanic garden establishment at St. Vincent was removed to Trinidad in May 1823.†

After this time the fortunes of the garden steadily declined. It was found, however, that "no neglect could prevent from flourishing the "few beautiful trees which still ornamented the ground. One of these, "and one which especially struck a stranger, was the Cannon Ball tree. "It attained a height of nearly 100 feet, and the fruits which clustered "on the trunk resembled thirty-six pound shot. The flowers borne by "this noble tree were red and white, assuming a shell-like form."

A local handbook published in 1884, from which the above is taken, states that "the disappearance of some of the rarest trees known to have "been left in this garden must be attributed to the fact that no public "servant was left in charge of the grounds. Each Lieutenant-Governor "or Administrator appointed and paid his own gardener, who was "usually only a labouring man. Thus knowledge of the value and "rarity of the trees was lost and intervals of neglect were frequent. In "1828, after the discontinuance of the vote for the upkeep of the "garden, a sum of about 2,000*l.* was voted to build a residence for the "Governor, by adding to the cottage formerly occupied by the Superin-"tendent. This residence was completed, and is still [after being "rebuilt in 1886] occupied by the chief executive officer of the island."

The establishment of the botanical station was begun, as already mentioned, in May 1890. The progress made up to December of that year when the station was visited, in the course of his mission in the West Indies, by the Assistant Director of Kew, is given in the *Kew Bulletin*, May and June 1891, pp. 140–145. Since that time the suggestions offered to the Government for laying out the garden and for devoting it "to the discharge of the special functions assigned to it in developing "the resources of the island" have been steadily and intelligently carried out.

The botanical station is under the personal direction of the Administrator, Captain Maling, C.M.G., who takes the deepest interest in its welfare. Much of the success which has hitherto characterised the

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* Attached to this account is an appendix with a "Catalogue of plants in His "Majesty's garden in the island of St. Vincent, September 24, 1806." This list includes about 1,380 plants, many of them indigenous to the island. Of the introduced plants most of them still exist either at St. Vincent or in the botanical gardens at Jamaica and Trinidad.

† Shephard's St. Vincent (1831), Appendix, lxxvi.

work of this station is due to the sympathy and encouragement which the Administrator has shown during the course of its development. It is felt that the island is indebted to him for the active part he has taken in guiding and directing the efforts of the Curator in the channels best calculated to meet local requirements.

The services of the Superintendent of the botanical gardens at Trinidad, Mr. J. H. Hart, F.L.S., have been utilised from time to time, with the consent of the Government of that island, to supervise the station, and numerous plants have been received through the active co-operation of this officer.

In December 1890 the Curator reports:—

"During the latter part of November and the beginning of December a considerable portion of my time was taken up in collecting and preparing the principal fibres of the colony for the Jamaica Exhibition, also in assisting in the preparation of botanical specimens of nearly the whole of the plants possessing economic and commercial properties in the colony."

These specimens proved of great interest and value, and they are mentioned in the official correspondence reproduced in the *Kew Bulletin*, May and June 1891, p. 166. Amongst the local plants yielding fibre is an Aroid plant little used elsewhere. This is *Xanthosoma sagittifolium*, Schtt., known locally as "China." The petioles of the leaves are macerated in water, and a somewhat coarse fibre extracted from them. A form of *Agave rigida*, with short leaves, was found in St. Vincent by Mr. Hart, and latterly there has been received from that island for identification a specimen of *Furcræa gigantea* var. *willemetiana*. This is similar to the Mauritius hemp plant, but with some teeth.

In laying out the garden the original avenue leading from the Superintendent's house (now Government House) has been maintained. Numerous trees have been planted to replace those lost, and advantage has been taken of the natural undulations of the land and of the presence of a running stream to make the institution as attractive as possible.

The old established trees in the garden will be carefully preserved. Many of them, such as the Cohune Palm of British Honduras and Tobago (*Attalea Cohune*), the Teak (*Tectona grandis*), the Betel Nut Palm (*Areca Catechu*), and the interesting *Catostemma fragrans*, Benth., are of majestic size. The soil in the garden has apparently lost little of its fertility, while the presence of water in the immediate neighbourhood keeps the air at all times cool and humid.

The interest taken in the botanical station by local residents is shown by the following extract from the Curator's report, dated March 31st, 1891:—

"It is pleasing to note that the number of visitors to the garden, more particularly on Sundays, continues to increase. For the convenience of visitors a number of garden seats have been requisitioned from England."

Economic plants raised at the station are sold locally at a nominal rate. The sum received for the sale of plants in June last was 2*l*. 19*s*. 8*d*. The object is not to make a revenue by the sale of plants, but to endeavour to secure an appreciation of the value of the plants to the recipients, and to obtain for them careful and suitable treatment after they have left the garden. The general experience is that where plants are distributed free of cost they are often neglected, and large numbers are lost without any compensating advantages.

As showing the useful though unpretentious work performed by this station, the following report for the quarter ending June 1891 is reproduced in full :—

Botanical Station, St. Vincent,
15th July 1891.

"I beg to submit my [seventh] report on the Botanical Station for the quarter ended 30th June.

"Since the 1st of June two additional gardeners have been employed, making a total of six.

"The number of prisoners available for work at the garden since the 1st April to the 28th April inclusive averaged six daily. Since the above date they have been employed assisting in the formation and completion of the walk leading from Government House to the botanic garden, under the direction of the clerk to the colonial engineer.

"The twelve garden seats which were ordered from England arrived by the SS. *New York City* on the 3rd June, and for the convenience of visitors have been placed in different parts of the garden.

"Notice boards to which the rules and regulations for the guidance of visitors are affixed have also been set up in conspicuous places in the garden.

"About 540 square yards of turf have been cut in the lower end of the garden, and laid principally on either side of the central walk, and about 103 cubic yards of soil and 'terras' have been removed and utilised in filling up an adjoining low place, to form a walk about 140 feet long, leading from the central walk to the new seed-raising house.

"A stone drain, about 16 feet long, over which the walk crosses, has been built.

"The lengths of open drains cut during the quarter are as follows:—160 feet long by 18 inches wide, 260 feet long by 1 foot wide.

"About 14 perches of ground have been deeply trenched and planted with about 480 plants, including cabbage, savoy, *Chou de Burghley*, and cauliflowers. Previous to planting, holes were cut, and about a quart of well decayed pen manure placed in the bottom of each; soil was then placed on this, and the plants carefully transplanted from the beds where the seedlings had previously been picked out. Turnips and spinach have also been sown on a portion of this ground.

"A border about 222 feet in length and 6 feet in width, running from the Tennis court in the direction of the entrance to the garden, has been made, and planted with a mixed collection of flowering and foliage plants porpagated in the garden.

"During April about an acre and a half of bush was cut down and cleared.

"With the exception of about an acre in the north-west corner, the whole of the garden, including the Banana, Sisal hemp, Pine-apple, Sugar-cane ground and nursery beds, has been thoroughly cleaned.

"One hundred and seventy nutmeg plants have been transplanted from the nursery beds, and permanently planted on the site of the former groves of nutmegs which were blown down during the cyclone of 1886.

"Seventy plants of *Theobroma cacao* (cocoa) have also been permanently planted in the banana ground, where a few cocoa plants previously planted are making fair progress.

"During the period under review, the following have been planted, viz.:—17 plants of the Ceara rubber (*Manihot Glaziovii*), which is

exciting so much interest at the present time amongst planters in various parts of the tropics; 6 plants of *Hevea brasiliensis*, or Para rubber, another valuable rubber tree; 12 plants of *Agave rigida* (true variety); 2 plants of *Bauhinia acuminata;* 4 plants of *Cassia siamea*, an ornamental tree, the timber of which is hard and durable; 2 plants of *Cassia fistula* (purging cassia); 5 plants of *Ficus Carica* (the Fig); 4 plants of *Calliandra Saman* (Rain tree); 2 plants of *Pachira spruceana;* 22 suckers of the *Charlotte Rothschild* (Pine-apple); 13 suckers of *Ripley Queen* (Pine-apple); 6 plants of *Poinciana regia* (Flamboyant); 3 plants of *Sesbania grandiflora;* 12 plants of *Vitis vinifera* (Grape vine).

"Two parcels of botanical specimens of the undetermined trees in the old and new gardens have been forwarded to Kew to be determined. Mr. Morris writes me: '*Catostemma fragrans*, Benth.,* is a very use-'ful tree for distribution to other botanical stations; it is probably not 'met with in any other West Indian Island. The fruit was received 'at Kew for the first time.' The following extract is taken from the *Treasury of Botany*:—'*Catostemma* is a genus of the myrtle family '(Myrtaceæ), and found in British Guiana. The only species known '(*C. fragrans*) is a tree about 50 feet high, The fruit is not known.'

"The next most interesting plant in the collection according to Mr. Morris is *Pachira spruceana*, Dcne., which has large tassel-like flowers from 12 to 15 inches in length.

"Dr. Nicholls, during his recent visit to this colony, informed me that one species of Pachira is a very useful shade and shelter tree for cocoa, being used in some places for that purpose.

"Mr. Morris further states that *Jacaranda obtusifolia* should prove interesting, and that the Pepper vine, which is growing in great profusion above Government House, is identical with the *Piper Betle* of Ceylon and India, and deserves to be protected.

"In his lecture delivered at the Court House, on the 27th December last, Mr. Morris stated that the Sansevieria or Leopard Lily, a valuable fibre plant, could be readily propagated by cutting the leaves into lengths, and inserting the same in sandy soil. About 700 plants have been already obtained in this way.

"The original plants were received from Jamaica (12 plants) and Trinidad (6 plants) in July 1890.

"The collecting of bamboo stems for using as plant pots, and the placing of seedlings in same, is being proceeded with.

"I attach lists† showing the number of plants sold during May and June, the proceeds of which have been paid into the Treasury, the number of plants for sale at the garden, with the prices attached, and lists of the plants and seeds received from and forwarded to other botanical stations.

"(Signed) H. POWELL, Curator."

In October 1891 the Curator prepared information, afterwards published in the *Government Gazette*, on the cultivation of the Grape Vine at St. Vincent. A supply of cuttings of the best English cultivated grapes was sent out from Kew in November 1890, and from these 200 plants were raised. A further supply of vine cuttings, figs, and pine-apples was despatched in February 1891. A memorandum on the cultivation of the pine-apple was published by the Curator, with

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* *Icones Plantarum*, pl. 1986. † Not reproduced.

his report for the month of December 1890. Plants of the sugar-cane known as the "Caledonian Queen" were introduced from Barbados, and grown in the garden to supply local demands. Plants of the *Gros Michel* banana, indentical with the well-known Jamaica banana, largely shipped to the United States, were also introduced to St. Vincent, and established at the botanical station. These have since been propagated and distributed to various estates in the island.

In a later report, dated 31st December 1891, Mr. Powell discusses the use of manure for the cultivation of tropical plants :

"During the period under review about 250 bushels of stable manure have been obtained from the manure heap at Government House, and utilized in the garden. On more than one occasion my attention has been drawn to the accumulation of manure at the back of Paul's Lot, where at the present time several hundred cart loads are lying. This manure is composed of the sweepings of the town, stables, &c., all of which in England would be turned to good account. To one who has been brought up in an English garden, and who has been accustomed to see every bushel of manure carefully husbanded, the waste of valuable manure which goes on in Kingstown is simply astounding. The soil which has come under my notice in this colony is, for the most part, of a light, sandy, non-retentive nature, and, if good crops are desired, renders the heavy application of manure a necessity. To expect impoverished land to produce good crops is like expecting a half famished horse to do the same amount of work as a well fed one."

A very suitable and attractive looking house has lately been built for the Curator, under the direction of Mr. David S. Osment, the colonial engineer. The total cost was estimated at about 350*l.* A plan has been prepared from Mr. Osment's drawings, and as this may very well be adopted as the type of a suitable house for curators in charge of botanical stations in the tropics, it is reproduced in the present number. Mr. Powell took up his residence in the house on the 3rd November last. He states that two rooms in it will be set apart for the use of the station, one as an office and library, the other for herbarium purposes. At present the library consists of a number of useful books, a list of which is given in the report of the station for the quarter ending 30th September 1891.

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## CCXLII.—MISCELLANEOUS NOTES.

The Botanical Department of Columbia College, New York, has sent a further parcel of Dr. Morong's PILCOMAYO plants.

From the TRANSVAAL, Mr. E. E. Galpin, F.L.S., has sent a small, but very interesting, collection of dried plants, in continuation of many previous consignments. A fine new species of *Anthocleista* is the most striking plant among them.

Dr. H. Baillon, Professeur d'Histoire Naturelle, Faculté de Médecine, Paris, has presented a collection of about 400 species of MADAGASCAR PLANTS, about half of them from the western side of the island, whence we had almost nothing, as no English travellers have collected on that side, except John Forbes, who seems to have landed and picked up a

few things. A considerable number of the specimens are types of novelties published by Dr. Baillon, and therefore possess a special value. Among these novelties are *Aprevalia* and *Boudouinia*, two very remarkable new genera of *Leguminosæ*.

The Rev. R. B. Comins has sent a second small collection of dried plants from the SOLOMON ISLANDS, including several highly interesting things. Specially interesting among these are flowering specimens, though not perfect, of the tree that bears the so-called turtle-seeds of the islanders. This tree belongs to the *Sapotaceæ*, and will shortly be published as a new genus of that order by Mr. W. B. Hemsley. The seeds are one of the most singular productions in the vegetable kingdom, and the name given to them by the natives of the Solomon Islands is quite appropriate, as the resemblance is most striking. Mr. Comins collected seeds of what appears to be a second species of the genus, and Kew previously possessed a seed and foliage of a third species, collected in the Fiji Islands in 1878 by Mr. Horne, the Director of the Botanic Garden of Mauritius. There are also seeds of one or two other species in the Museum, where they have been for some years, but their origin is unknown.

Another very curious plant collected by Mr. Comins is *Lasianthera papuana*, in which the originally three-celled ovary develops into a fruit with one fertile, dry, woody cell, the two empty cells forming a fleshy body on one side of it.

The Palms and Pandanads, which, with the Cycads, now form the most striking feature of the large PALM HOUSE at Kew, have increased so much in size as well as in number, as to necessitate a re-arrangement of the whole of the plants to provide more ample accommodation for the specimen Palms. These now occupy, with other large monocotyledonous plants, the whole of the central part of the house and the north wing, excluding the side shelves. The large Cycads, with the large dicotyledonous plants are arranged chiefly in the south wing of the house. The small Cycads are on one of the side shelves.

Plants of the interesting DOUBLE COCOA-NUT or *Coco de mêr* (*Lodoicea seychellarum*) have been raised at Kew from nuts and a germinating plant forwarded to this establishment by the Honourable T. Risely Griffith, Administrator of the Seychelles. The largest plant is now developing its third leaf; the dimensions of the second leaf, developed last year, are as follows:—Length of petiole 30 inches, length of blade 4 feet, width of blade 4 feet, number of folds in blade 56. The midrib of the leaf describes a semicircle, and the whole of the divisions, which are a foot long, are recurved. This plant will shortly be placed in the Victoria House, where there are now young healthy examples of the following somewhat rare PALMS in cultivation:—*Mauritia flexuosa*, *Manicaria saccifera*, *Hyphæne thebaica*, *Borassus flabelliformis*, *Bismarckia nobilis*, *Pholidocarpus Ihur*, *Licuala grandis*, and *Socratea exorrhiza*.

PODOCARPUS PECTINATA.—At Kew there is a species of Podocarpus in cultivation, lately received from Mr. Moore, of the Sydney Botanic Garden, with the information that it was a native of New Caledonia.

The same species apparently is in cultivation elsewhere in this country, and it is suggested in the "Gardeners' Chronicle" (3rd series, xi. p. 113), that it might be the "*P. pectinata* of Brongniart and Gris, a "specimen of which is in the Kew Herbarium, authenticated by one of "the authors; but we have not succeeded in discovering whether or no "the species has been published."

The suggestion is a good one, and we have no hesitation in referring the plant to the species in question; but Brongniart and Gris did not publish it under *Podocarpus*. They described it (*Bulletin de la Société Botanique de France*, xvi. p. 330) as *Dacrydium Pancheri*, with a note to the effect that Pancher, who collected it in New Caledonia, had attached the name *Podocarpus pectinata* to the specimens. Bentham and Hooker (Genera Plantarum, iii. p. 435) refer this and some allied species to their section *Dacrycarpus* of *Podocarpus*, and following this we must write *Podocarpus pectinata*, Pancher.

There are about 50 known species of PODOCARPUS, and they are distributed over the sub-tropical and sub-alpine regions of both hemispheres. The following are represented by living examples in the Kew collections:—

Cultivated in the open air: *P. alpina*, R. Br., Tasmania; and *P. chilina*, Rich. ("Maniu," "Pino"), Chili.

Cultivated in the Temperate House (Winter Garden): *P. bracteata*, Bl., Java; *P. cupressina*, R. Br. ("Kimerak," "Ki-poetri"), Java; *P. dacrydioides*, A. Rich., New Zealand; *P. elongata*, L'Herit. ("Outeniqua," "Geelhout," "Yellow wood"), S. Africa; *P. elata*, R. Br., Australia; *P. japonica*, Sieb., Japan, and *P. japonica* var. *variegata*; *P. macrophylla*, Don ("Maki"), Japan; *P. Nageia*, R. Br. ("Nagi," "Tsikkura-Siba") Japan, and *P. Nageia* var. *rotundifolia*; *P. neriifolia*, Don, Nepal; *P.*, *nubigena*, Lindl., Island of Chiloe; *P. spicata*, R. Br. ("Mai," "Mataii"), New Zealand; *P. taxifolia*, H. Bk., New Granada; *P. Totara*, Don ("Totara"), New Zealand.

Cultivated in the stove: *P. coriacea*, Rich. ("Yacca"), Jamaica; *P. cupressina*, R. Br., Java; *P. pectinata*, Panch., New Caledonia; *P. purdieana*, Hk., Jamaica, Cuba; *P. salicifolia*, Kl. Karst, West Indies.

Strawberries are often tried in the tropics, but with varyin success. In the cool climate of the hills they do very well for a time, but even there the choice sorts appear to deteriorate, and to require to be renewed at frequent intervals. Plants packed in Wardian or dry cases travel rather badly, sometimes as many as one-third to one-half being lost in one sending. To obviate this efforts have occasionally been made to send out seed selected from good sorts. In acknowledging the receipt of some seed forwarded from Kew, Mr. M. A. Lawson, F.L.S., Director of the Botanical Department, Madras, writes from Ootacamund, 15 February 1892:

"I shall be very glad to try the strawberry seeds, but my attempts in that line have not been a success hitherto; as the plants raised from seed have always harked back to the old Alpine variety.

"We have, nevertheless, very good strawberries both in Ootacamund and Bangalore, but they are grown only on a small scale.

"I am trying to domesticate our wild strawberry of these hills, but as yet I have done no wonders with it."

Mr. A. Henderson, Runnymede, Florida, under date of February 12,

1892, writes: Strawberries have just commenced, and they will keep "on until May. We have here a particular kind, consisting of three "varieties, that does exceedingly well in warm countries. The "runners are cut off until May (when the crop ends). This is a "perpetual fruiting kind. The northern and English varieties will not "thrive here."

In the Blue Mountains, Jamaica, a wild strawberry, supposed to be an escape from gardens, is found very abundantly at elevations of 4,000 to 5,000 feet. The fruit is regularly gathered and sold in the Kingston market.

The following note on GINSENG is given in the *Official Guide* to the Museums of Economic Botany at Kew (Dicotyledons and Gymnosperms), p. 87 :—

"Ginseng, the root of *Aralia quinquefolia*, A. Gray, var. *ginseng*, Reg. et Maack, is native of North China. It is so highly valued as a tonic and stimulant medicine in China that it is sold at from 20 to 250 times its weight in silver, sometimes for 500 times this amount. It possesses no important medicinal properties. Corean ginseng is the principal article of export from Corea into China. It ranks in quality next to the Manchurian or Imperial. The red, or clarified Corean ginseng is made by steaming the roots for about four hours in wicker baskets enclosed in a closely fitting earthernware vessel pierced at the bottom with holes, and placed over boiling water. Note also roots of *A. quinquefolia*, A. Gray, from North America, having slight demulcent properties, collected in the Alleghany highlands from Pennsylvania to Tennessee, and sold at a dollar a pound for exportation to China as a substitute for the Chinese product. The average importation (of 20 years) mainly through Hong Kong is about 400,000 lbs. It is ranked by the Chinese as about fourth in quality, Japanese being the least esteemed."

Efforts have been made from time to time to establish the COREAN GINSENG plant at Kew. Recently a small packet of seed was received at this establishment from Mr. Walter C. Hillier, Her Majesty's Consul-General in Corea, with the following interesting note, dated Söül, January 6th, 1892 :

"I have taken some time to reply to your letter of last May with regard to Ginseng seeds, owing to the great difficulty I have experienced in procuring any. The Coreans are very loth to part with seeds for fear that their practical monopoly in this root should be invaded, and I had almost despaired of success. I am happy to say, however, that I have at last managed to get a small quantity of seed from the large Government Gardens at Songdo, the ancient capital of this province, some 60 miles from this city. I am sending you these seeds under separate cover, and I shall be interested to hear what success you have met with in the attempt to make them grow. You will probably not require any hints as to cultivation, but it might be useful to you to know the system adopted by the Coreans. The seeds are sown in the spring in beds of fine leaf mould, no manure being used. The beds are raised about a foot and a half, are protected from the north winds, and screened at night with mats, an awning of mats being placed over the beds during the fierce heat of summer. At the end of the first year the plants are set out, and it takes five or six years for them to reach maturity. The yearly range of temperature at Songdo is wide, say from zero to 90° Fahrenheit."

There has lately been presented to the Museums of Economic Botany at Kew, by Mr. Joseph Sturge, Managing Director of the Montserrat

Company, Limited, a specimen of L'ECUELLE (porringer), an interesting instrument used for extracting the odorous principle from the rind of the fruits of the orange, lemon, and lime. This consists of a copper basin about nine inches in diameter. The concave inner surface is furnished with studs about half an inch long, with rounded points, rivetted in closely packed rows in the lower portion of it. There is a hole at the bottom leading into a long narrow funnel about six inches long, which also serves as a handle. A figure of this instrument is given in Piesse's *Art of Perfumery*, 1879, p. 150. The specimen presented by Mr. Sturge is one that has been in use for many years for extracting "essence of limes" on the Montserrat Company's estates in the West Indies. The instrument is held in the left hand, the fruit is taken with the right and gently rubbed with a circular motion on the projections inside the basin. This action bruises the oil glands in the rind, and the oil flows in small quantities on to the surface of the studs. Thence it trickles down to the bottom of the basin and the funnel below. The process is obviously a slow one, and it is necessary to have at least two or three dozen operators, and plenty of limes for them to work upon. In the West Indies negro women and girls are usually employed. These sit down close to a large heap of limes and roll the fruits quickly one after the other on the projections inside the basin. It generally takes some hours to extract a sufficient quantity of essence to fill the funnel, holding about a fluid ounce. When this is done, the essence is taken to the storeroom, and placed in a large glass jar to clarify ready for shipment. Piesse states that the essence prepared in this manner at Montserrat is so pure "that it is worth twice its present price in the market."

A minute BORING BEETLE, about one-twelfth of an inch long, identified by Mr. W. H. F. Blandford, F.Z.S., as *Xyleborus perforans*, Wollaston, appears to have become injurious to sugar canes in the West Indies. This beetle was described by Wollaston from specimens perforating the bungs of wine casks at Madeira. Mr. Herbert H. Smith lately engaged in exploring the Fauna of St. Vincent, found the beetle in sugar canes in that island, but he was of opinion that it only attacked canes already injured by the well-known moth-borer (*Chilo saccharalis*). He adds that "it is common in all parts of tropical America, frequenting "rotten vegetation, and especially cane refuse. On the Amazons it bores "into rum barrels. It is one of the insects that is most frequently "attracted by lights at night." Mr. Blandford states that this insect has been known for thirty years as destructive to beer casks in India and it also occurs through the Bornean archipelago. It is, however, distinct from the species described as injuring barrels in *Kew Bulletin*, 1890, p. 181. Specimens of this same beetle have been received from Barbados and Trinidad. In both places it is said to attack growing canes and to prove destructive. If this view be confirmed, it would appear that a beetle hitherto confined to dry and rotten wood and vegetable *débris* has now become injurious to living plants. There should, however, be no difficulty experienced by intelligent planters in the West Indies in dealing with this new cane borer. The infested canes should be destroyed, either by burning or passing through the rollers of the cane mills. Care should be devoted to the selection of "plant" canes, to ensure that they are free from the grubs and eggs of the beetle, and precautions be taken to get rid of all cane refuse in a decayed state in the neighbourhood of the cultivated fields. In other respects the same steps are necessary with this borer as have been found effective in the case of the moth-borer. This latter has been known to attack sugar canes at intervals for nearly 60 years, but its influence has

been rendered comparatively harmless by the systematic destruction of infested canes, and by examining and dressing the "plant" canes before they are put out in the fields. These simple and effective methods are fortunately within the reach of every one.

THE AKEE (*Blighia sapida*, Kg.) a well-known African tree belonging to the soap-berries (*Sapindaceæ*), is naturalised in the West Indies and other parts of tropical America. The creamy aril forming a succulent socket surrounding the base of the seeds affords, when cooked, a very palatable food. Occasionally, however, cases of poisoning by Akee have been recorded. In Jamaica recently a mother and children are believed to have died through eating Akee. Mr. J. J. Bowrey, F.C.S., F.I.C., Government analytical chemist, has communicated a report to the Government of Jamaica on the wholesomeness of the Akee as an article of food as follows :—

(1.) Unripe Akees if eaten freely bring on vomiting. (2.) Decaying Akees are decidedly unwholesome, and may be even very poisonous. This is true of many foods. (3.) Fresh ripe Akees are good and harmless food, rather rich it is true, but to most persons quite wholesome. There may be individual idiosyncrasies with regard to Akee, as there are to such usually harmless foods as mutton, duck, pork, mushrooms, &c. (4.) The red membrane of the Akee, so commonly believed to be poisonous, is perfectly harmless. (5.) If the fruit be ripe and fresh, which can be known by its being open, the edible portion firm, and the red part bright in colour, I consider it a good and safe food. But if the fruit be not ripe, or if there are any signs of decay, such as mouldiness or softening of the edible portion, or a dingy colour in the ordinarily red-coloured part, the fruit should not be eaten."

The cultural industries at the GAMBIA have been discussed in the *Kew Bulletin*, June 1889, p. 142, and December 1890, p. 261. The botany of the Gambia Delimitation Commission is given in the *Bulletin* for October and November 1891, p. 246, and February 1892, p. 45. In a letter, dated 24th February last, His Honour R. B. Llewelyn, C.M.G., Administrator of the Settlement, points out the almost insuperable difficulties experienced in endeavouring to establish cultural industries in this part of West Africa :—

"Since I came out here in April, between attacks of fever and expeditions against chiefs I have had very little time to look after agriculture. What can be done in a country when, practially speaking, there is not a single drop of rain for eight months in the year? The time to collect botanical specimens is during the rainy season, when everything is green, but then that is the time when Europeans cannot tramp about without great risks. The island of St. Mary, on which Bathurst stands, is merely a bank formed by *débris* from the river, and is barely above high-water mark. In the rainy season it is covered with water, as there are no means of draining it.

"During the dry season English vegetables, cabbages especially, grow well, but they have to be watered. I have prepared and published a comparative rainfall and a few meteorological statistics which I enclose. [Reproduced below.] With the natives, ground nuts are, as you know, the staple product. Oil mills in Marseilles receive nearly all that are grown. The difficulty here is getting fresh water to keep young plants alive during the eight months' drought. I hope to be in England in July, and before I return in November I must try to see you. At

present I cannot see any chance of doing much to improve the exports. Large bush fires, lighted indiscriminately, destroy young trees planted out. I have distributed rubber plants and cocoanuts; a few of the former are doing fairly well at Cape St. Mary."

COMPARATIVE RAINFALL in the COLONY of the GAMBIA.

| — | 1887. | 1888. | 1889. | 1890. | 1891. |
|---|---|---|---|---|---|
| January - - | — | ·02 | — | — | ·01 |
| February - - | — | — | — | — | ·16 |
| March - - | — | — | — | — | — |
| April - - - | — | — | — | — | — |
| May - - - | ·23 | — | — | ·04 | ·53 |
| June - - - | 1·67 | ·58 | 1·16 | 2·40 | 4·67 |
| July - - - | 11·38 | 8·54 | 3·23 | 16·42 | 7·42 |
| August - - | 19·82 | 13·47 | 15·57 | 19·90 | 18·84 |
| September - - | 13·70 | 9·71 | 10·65 | 16·58 | 19·81 |
| October - - | 7·16 | 6·77 | 1·45 | 4·97 | 1·97 |
| November - - | — | — | — | — | — |
| December - - | — | — | — | — | — |
| Total rainfall - - | 53·96 | 39·09 | 32·06 | 60·31 | 53·41 |

Average 47·76 inches.

METEOROLOGICAL STATISTICS, BATHURST, GAMBIA.

| 1891. Month. | Average for Month at 7 a.m. | | | Maximum in Shade at 3 p.m. | | | Maximum in Shade at 7 a.m. | | | Total Rainfall in Inches. |
|---|---|---|---|---|---|---|---|---|---|---|
| | Dry Bulb. | Wet Bulb. | Dew-point. | Highest. | Lowest. | Average. | Highest. | Lowest. | Average. | |
| July - - | 87·8 | 76·2 | 74·5 | 92 | 82 | 86·7 | 78 | 68 | 73·4 | 7·42 |
| August - - | 76·8 | 75·4 | 74·2 | 88 | 75 | 83·7 | 75 | 70 | 72·7 | 18·84 |
| September - | 77·3 | 75·1 | 73·6 | 90 | 80 | 85·9 | 75 | 69 | 72·3 | 19·81 |
| October - | 77·5 | 75·4 | 73·5 | 90 | 83 | 87·4 | 77 | 69 | 73·1 | 1·97 |
| November - | 73·4 | 67·8 | 63·8 | 90 | 80 | 84·4 | 74 | 64 | 68·8 | — |
| December - | 69·8 | 63·3 | 58·4 | 92 | 80 | 84·7 | 68 | 62 | 65·7 | — |

31st December 1891.

G. Massee

Calospora Vanillæ, Massee.

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ROYAL GARDENS, KEW.

# BULLETIN

OF

# MISCELLANEOUS INFORMATION.

Nos. 65, 66.] MAY AND JUNE. [1892.

## CCXLIII.—VANILLA DISEASE.

(*Calospora Vanillæ*, Massee.) With plate.

In the year 1887 an appeal was made to Kew for assistance and advice in regard to a disease that had attacked vanilla plants in the Seychelles. These islands as well as Réunion and Mauritius have taken up the cultivation of vanilla and a not inconsiderable industry has been established there in recent years. The first information respecting the disease was contained in a letter written by Mr. J. J. Sharp, dated 10th May, 1887 :—" I have referred previously to the Sans Souci Estate " in one of my letters to you, remarking upon the fine and healthy " appearance of the vanilla vines and pods, but it appears Mr. Edwards " finds hundreds of pods are damping off, and as is always the case, the " plumpest and finest pods succumb first. These turn black at either " end or in the centre, and in the course of a day or two drop off the " vine. . . . Mr. Edwards said the disease was confined to a given area, " and then he admitted it was a flat, damp piece of land without " sufficient drainage. This is exactly what happened at the Cascade " Estate and under exactly the same conditions when they lost a very " large quantity of pods."

The disease after this time appears to have become more general in estates in Mahé, and in order to protect the planters in their efforts to deal with it, a Regulation was passed [No. 3 of 1887], " to prohibit the introduction of vanilla creepers " into the Seychelles from Mauritius and Réunion islands. At that time it was believed that the vanilla plants in the latter islands were also affected. This, however, does not appear to have been the case. In reply to applications made to Kew the following correspondence was addressed to the Colonial office.

ROYAL GARDENS, KEW, to COLONIAL OFFICE.

Royal Gardens, Kew,
October 27, 1887.

SIR,

I AM desired by Mr. Thiselton-Dyer to inform you that he has received from the Seychelles direct, as well as from the Director of

Forests and Gardens at Mauritius, correspondence and specimens bearing upon a disease which has appeared amongst vanilla plants at the Seychelles.

2. Specimens of diseased vanilla pods were received here from Mr. E. H. Edwards, a planter at the Seychelles, with a letter dated the 10th May 1887, and subsequently (31st May) we were addressed on the same subject by Messrs. Wright, Layman, and Umney, wholesale druggists in the City, who forwarded correspondence received by them from the Seychelles. Recently (September 10th) we received from the Director of Forests and Gardens at Mauritius specimens of vanilla obtained from the Seychelles with insects upon them. These latter were supposed to be in some way connected with the disease.

3. The vanilla cultivation is well known to be a staple industry of the Seychelles, and Mr. Thiselton-Dyer fully shares the opinion that anything affecting its permanence and welfare is a matter of deep importance to the inhabitants.

4. After a careful consideration of the circumstances as so far presented to him Mr. Thiselton-Dyer is of the opinion that the cause of the disease is to be sought not in any insect or fungoid pest but in the situation and nature of the soil and drainage.

Mr. Scott, the Assistant Director of the Gardens at Mauritius, appears to have arrived at the same conclusion. He states in a letter (received here 2nd May 1887), "In my opinion there is no disease. The plants are only exhausted from overcropping, bad drainage, want of shade, &c."

5. The pods received from Mr. Edwards were so decomposed that it was impossible to trace anything upon them. The specimens of insects received on pods from the Director of Forests and Gardens at Mauritius proved to be mites (Acari), and in the opinion of an officer of the British Museum (Natural History), to whom they were submitted, "it does not seem probable that they are the cause of the disease."

6. The investigation of a disease of this kind can only be satisfactorily pursued on the spot and after observations have been continued during one complete season; but the information at present available points to questions of drainage and shade, which are matters well within reach of the cultivators themselves.

I have, &c.
(Signed) D. Morris.

The Hon. R. H. Meade, C.B.,
Colonial Office.

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Royal Gardens, Kew, to Colonia Office.

Royal Gardens, Kew,
November 23, 1887.

Sir,

With reference to my letter of the 27th October on the subject of the disease of vanilla pods at the Seychelles, I am desired by Mr. Thiselton-Dyer to forward the enclosed copy of a letter received from Mr. George Massee, to whom diseased vanilla pods received in May last were given for examination.

2. It appears after careful inquiry that Mr. Massee has detected in the pods a parasitic fungus belonging to the genus *Peronospora;* but before he can arrive at any practical conclusion it is necessary to obtain a supply of vanilla pods in different stages of growth for detailed examination.

3. Some of the pods might be sent in spirit whilst others might be sent in a small box, in a living state, attached to portions of the vine.

I have, &c.

The Hon. R. H. Meade, C. B., (Signed) D. Morris.
Colonial Office.

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Enclosure.

A fungus belonging to the *Peronosporeæ* has been detected in the tissues of the vanilla pods received from the Seychelles. It is desirable that further material should be examined in order to ascertain the relation between fungus and disease. Specimens of pods, as rotten as possible (from the disease), even those of last season, if obtainable, should be placed in spirit, and other pods in the earliest stage of disease, showing a white mouldiness outside, sent alive.

(Signed) G. Massee.

The specimens desired for investigation at Kew were received from his Honour T. Risely Griffith, C.M.G., the Administrator of the Seychelles, in February 1890. They were submitted for examination to Mr. Massee, who has prepared the following exhaustive Report:—

In May 1887 Mr. D. Morris, M.A., F.L.S., Assistant Director, Royal Gardens, Kew, submitted to me for examination some vanilla "pods" or fruits from the Seychelles supposed to be diseased. Owing to imperfect packing the material proved useless for investigation. In February 1890 a second consignment was received representing every stage of the disease, which shows conclusively that the disease is caused by a microscopic fungus, *Calospora vanillæ*. *Vanilla planifolia*, Andr., is the species cultivated.

The first consignment consisted of "pods" or capsules only, and these, having been wrapped up while damp in lead paper, arrived in a half-decayed condition and completely covered with minute fungi such as *Eurotium herbariorum*, which had undoubtedly developed during the journey, thus rendering useless the material for investigation. A small species of *Pythium* was met with in fair abundance in the tissues; but this, as will be shown, had nothing to do with the disease that was causing the wholesale destruction of the vanilla plants.

The second lot of material arrived in excellent condition, and illustrated every stage of the disease from the earliest indication of its influence on the aerial roots to the dry and shrivelled leaves and stems, and included also a good supply of material in alcohol. The living stems had been cut into pieces about half a yard long, each piece bearing two or three leaves and aerial roots, often two yards or more in length. These pieces, over 30 in number, were packed between thick layers of blotting paper, and on being opened out were perfectly fresh and without a trace of mould, due probably to the moisture from the specimens having been absorbed by the superabundauce of blotting-paper. The whole were packed in an air-tight box.

A preliminary examination of the material showed the presence of three apparently distinct species of fungi, distributed as follows:—

On some of the living leaves exceedingly minute subtremelloid pustules of a dull red or amber colour were present, springing in small groups from slightly discoloured patches. These were most abundant on the upper surface of the leaf, but in some instances occurred on both

surfaces and are only just visible to the naked eye, rarely reaching 5 mm. in diameter. A microscopic examination showed that the pustules consisted of masses of gonidia belonging to a fungus agreeing with the characters of the genus *Hainsea* of Saccardo and Ellis. As to whether *Hainsea* is distinct from *Glœosporium* seems more than doubtful; this, however, is immaterial in connexion with the present investigation, as the *Hainsea* will be shown to be simply a form species. Some of the leaves showed no external trace of the fungus; but mycelium was present in the tissues, and in some instances the *Hainsea* appeared at a later stage on leaves that were placed under a bell-jar and kept moist. Some time after the fungus has made its appearance on the leaves it also shows itself on the stem and aerial roots, which originate from the stem laterally too, and close by the insertion of the leaves; but it rarely extends for more than an inch from the insertion of the leaves, and its presence on these organs is due to the extension of mycelium from the leaves.

All the dying and dead leaves, along with those portions of the stem indicated above, were studded with the pale yellow waxy-looking, agglutinated masses of gonidia belonging to the form-genus *Cytispora*. The gonidia, when mature, exude through the ruptured epidermis of the leaf in the form of minute, elongated, viscid filaments, being held together by mucus derived from the gelification of the external portion of the walls of the gonidia. These filaments in drying assume various irregular masses, which persist on the surface of the leaf for a considerable time. These masses are arranged in more or less circular groups, extending to ·5 cm. in diameter; not unfrequently most of the viscid filaments forming a group become confluent while moist, and form an irregular waxy cake. The clusters are usually produced in such close proximity that the whole surface of the leaf is practically covered. The *Cytispora* is most frequently confined to the upper surface of the leaf, but not unfrequently both surfaces are covered. At a later stage, like the *Hainsea*, the *Cytispora* extends to the stem for a short distance from the insertion of the leaves. In old bleached leaves where the *Cytispora* spore-masses have been removed by rain, the surface presents a blackened appearance due to the numerous black pycnidia of the fungus which originate in clusters from a common mass of pseudoparenchyma, the stroma. At a later stage the central portion of the stroma of the *Cytispora* produces perithecia, enclosing spores contained in asci, which agree in all essential points with the genus *Calospora*. The mycelium of the *Hainsea* form occurs in greatest abundance in the tissues just below the epidermis, running between the cells and surrounding them with a mesh of hyphæ, but not piercing their walls. The hyphæ are of uniform thickness, measuring from 3–3·5 $\mu$ in diameter. At certain points where several hyphæ cross, lateral branches are given off which become closely entangled and eventually form a small, colourless cushion of pseudoparenchyma which destroys the epidermal cells lying immediately above, the cuticle at the same time bulging up. From the lower surface of the stroma numerous hyphæ extend into the leaf between the cells, completely destroying the tissues. From the upper surface of the stroma, that is, the surface lying nearest the cuticle, numerous slender cylindrical aseptate hyphæ grow up side by side; these are the gonidiophores, which, from their first appearance are slightly clavate at the tips; these thickened apical portions continue to increase in size until they assume an elliptic-oblong form, and are then cut off from the gonidiophores by a transverse septum, and escape through the ruptured cuticle, forming the minute

amber-coloured masses of gonidia involved in mucus already described. The gonidiophores are simple or branched, variable in length, extending to 25 $\mu$ the average being about 14–16 × 3 $\mu$ the gonidia are constant in form and size, measuring 9-10 × 3·5–4 $\mu$, and, seen by transmitted light are almost colourless. Sown in water these gonidia germinate within 12 hours, emitting a germ-tube from near one end, which soon produces short lateral branches at right angles; the whole perishes within two or three days, and in several cultivations the development never passed beyond the condition described above. When sown in a sterilized decoction of raisins and gelatine, the gonidia germinated as above, but the mycelium was much more vigorous in its growth, although not thicker, measuring 3 $\mu$ in diameter, sparsely septate, and becoming slightly thicker near its point of origin from the gonidium. In rare instances two germ-tubes are produced, one from each end of a gonidium, but in such cases one of the two remains in a rudimentary condition. On the third day after the commencement of germination small elliptical, colourless, secondary gonidia measuring 4 × 2 $\mu$ are cut off from the tips of most of the branches.

These secondary gonidia, after becoming detached, reproduce themselves to an enormous extent by budding, but were never seen to emit germ-tubes. In flask cultures in a sterilized, clear solution of plums the gonidia within 10 days give origin to a copious weft of mycelium which produces microgonidia below the surface of the liquid; these reproduce themselves so rapidly by budding that the originally clear solution becomes turbid, and this continues until the nutritive material is exhausted, when the mass of yeast-like cells sink to the bottom like a precipitate. No further development could be obtained from the cells produced by budding although sown in varions nutritive solutions, including the liquid from crushed living vanilla leaves obtained from the Royal Gardens, Kew.

A quantity of leaf-mould mixed with water was thoroughly sterilized by intermittent boiling in a flask until the water had evaporated, leaving the soil moist, into this was placed two drops of the decoction of plums containing the budding condition of the secondary gonidia, the flask was closed with sterilized cotton wool,and kept at a temperature of about 70°F. for six days, when a quantity of water recently boiled and proved by microscopic examination to be pure was added, and the whole thoroughly shaken up; on examination the water was found to be charged with budding forms of the secondary gonidia in all stages of development, but prolonged examination failed to show any other form of development. Some of the cells exceeded in size the measurements given above, reaching to 6–7 × 4–5 $\mu$ and not unfrequently formed little colonies of concatenate gonidia of various sizes organically attached. The contents of the flask were kept under observation for some weeks, but no other phase of development was observed.

The above experiment suggests that when the *Hainsea* gonidia are washed off the leaves by rain and carried to the ground, they germinate and produce yeast-like colonies of cells by budding, but what these cells eventually give origin to is unknown. Living vanilla leaves were infected with the *Hainsea* gonidia, but always without result, although tried in a variety of ways both on the upper and under suface of the leaf, and by being placed in wounded parts, from which it may be concluded that the *Hainsea* cannot reproduce itself directly on the living vanilla plant.

By the time the *Hainsea* is fully developed, owing to the ravages of its mycelium, the leaf, has become yellow and is evidently dying, and at

this stage the *Cytispora* (=*Cytospora*, Sacc) begins to show itself in the form of verp minute clusters of black points covered by the cuticle. A section of the leaf taken through one of these clusters shows that the points are black-walled pycnidia partly sunk in a common stroma. This stroma, which is convex on the side next the epidermis, is formed from mycelium indistinguishable from that of the *Hainsea* which preceded it in the leaf, and gives off from its under surface and margin numerous septate, branched hyphæ about 4$\mu$ in diameter, the branches at once penetrate the cells of the leaf, where they usually form a coiled mass. The epidermal cells of the leaf have thick walls furnished with large pits, and it is through these pits, which are opposite to each other in contiguous cells, that the hyphæ pass from one cell to another, becoming very much attenuated in the pit and expanding again at once to the normal width on entering the cell. I did not succeed in observing the origin of the pycnidia from the substance of the stroma; but when fully formed, a vertical section through the stroma shows them to be circular in outline, with a slight prominence at the apex bordering a minute pore through which the gonidia escape at maturity. The pycnidia are frequently distorted from mutual pressure. The base of the pycnidium is buried in the substance of the stroma, and the whole structure has a thick wall of pseudoparenchymatous tissue composed of several layers of cells which appear in section, whether vertical or transverse, to be arranged in fairly regular concentric layers. The walls of the outermost layer are black or dark brown and rather thick, and sharply define the pycnidium from the stroma in which it is to a great extent immersed. Proceeding inwards the walls become colourless, very thin, and the cells are filled with granular, vacuolated protoplasm; the innermost layer gives origin to the slender gonidiophores, which vary in length, and produce at their tips the elliptic-oblong, colourless gonidia, measuring 14–16 × 6–7$\mu$. The gonidia at first have an external thin, hyaline, mucilaginous layer. The cuticle is ruptured by the upward development of the stroma and the gonidia ooze out of the pycnidia in the form of mucilaginous tendrils, which forms the pale yellow waxy masses on the surface leaf, as already described. The clusters of pycnidia are small at first; but the stroma continues to grow and increase its area for some time, at the same time producing pycnidia from the newer peripheral portion; there is no tendency towards a concentric arrangement of the pycnidia. *Cytispora* gonidia sown in water produced within two days one or two germ-tubes, which develop into much-branched septate hyphæ, the cells nearest the gonidium becoming swollen into a broadly elliptical or globose form and presenting a moniliform appearance, due to being constricted at the septa; no further development took place, and at length the mycelium died. In a nutritive solution development commences as above; but after a copious formation of mycelium stromata are formed as follows. At certain points, where several hyphæ intersect, numerous transverse septa appear, cutting the hyphæ into short cells; these cells give origin to lateral branches, which, after growing erect in a fasciculate manner for some distance, become irregularly branched, the branches becoming interwoven and forming a compact mass more or less spherical in form, the whole stroma resembling a sphere supported on a short, thin stalk that originates from the mycelium. At first the stroma has a well-defined outline; but eventually the external cells of the basal half nearest the stem-like base grow outwards as blunt papillæ; these elongate directly into septate, branched hyphæ, which radiate from the stroma on every side and pass directly into the nutritive solution for the purpose of supplying the developing stroma with nutrient material. In

slide cultures these stromata attain a diameter of 2 mm. in about three weeks, and are quite colourless. One promising example was watched from day to day for the appearance of black points which it was supposed would indicate the formation of pycnidia; but in this I was disappointed, and in place of black points a mass of gonidia was seen covering the stroma. The gonidia agreed exactly with those of the normal *Cytispora* produced on the leaves. The stroma, after remaining for some time in alcohol, was examined; a vertical section showed the presence of two pycnidia similar in shape to those already described, but differed in the almost total absence of colour from the outer cells of the wall, and in the fewer number of concentric layers composing it, only three being present. The umbonate apex did not project above the level of the stroma.

The spores germinated in a nutritive solution in a manner exactly similar to those obtained from the leaves, and there seems to be but little room for doubt but that the differences observed between the normal development and the slide cultures were caused by the different conditions under which the two were respectively developed. Living uninjured vanilla leaves infected with *Cytispora* gonidia yielded no results, the gonidia germinated on the moist epidermis, but the germ-tubes appear not to be able to pierce the epidermis, or to enter through the stomata; on the other hand, when the gonidia were placed on a portion of a leaf from which the epidermis had been removed, germination took place, and the mycelium spread in the tissues, followed by the production of pycnidia in small numbers and imperfectly developed, whereas when the gonidia are placed on a dying leaf, where disintegration of the tissues has commenced, pycnidia are produced in abundance. The above experiments show that the *Cytispora* is a true saprophyte, and will not reproduce itself on uninjured living vanilla leaves.

By the time the *Cytispora* has completed its development the whole of the sap and protoplasm has disappeared from the leaf, which is consequently dry and shrivelled, and so long as it remains in this condition no further fungal development takes place, but if the leaf is kept damp the *Cytispora* stromata produce perithecia from the central portion, which originate as follows. A vertical section through the central portion of the stroma shows a minute spherical weft of intricately interwoven hyphæ, filled with granular protoplasm and completely surrounded by a layer of slender, thin-walled, yellowish hyphæ somewhat concentrically arranged; the central weft appeared to be perfectly homogenous, and showed no trace of an ascogonium or "Woronin's hypha," but the difficulty of obtaining a median section and at the right time may possibly account for the absence of any differentiation in the central weft. For some time the entire body retains its spherical form but continues to increase in size, due mostly to the increase in thickness of the bounding wall, but also to some extent to the growth of the central weft; eventually the apical portion of the outer wall, or that portion nearest to the free surface of the stroma grows upwards in the form of a cone until it bursts through the stroma. At this stage the young perithecium is conical in outline with a rounded base, the basal portion enclosing the spherical weft of hyphæ, the bounding wall being 6–8 cells in thickness, pseudoparenchymatous below, but in the upper portion the hyphæ run in parallel rows. The two or three outer layers of the wall all round are at this stage differentiated by the dark colour and greater thickness of their walls, the walls of the inner layers being colourless, very thin, and containing granular protoplasm; the apical portion of the perithecium, consisting of parallel hyphæ,

continues to elongate and becomes slightly curved, forming the neck, and on the portion above the stroma some of the peripheral hyphæ become free from the wall and form hairs. Contemporaneous with the development of the neck of the perithecium, the cells of the inner rows of the basal portion of its wall commence to elongate in the form of blunt papillæ, which grow into the central weft of hyphæ, causing its complete disintegration, leaving a cavity into which the papillæ or young asci and paraphyses extend. Whatever the central weft of coiled hyphæ may be the homologue of, its behaviour in the present instance suggests its function to be that of forming the cavity of the perithecium, serving as a nucleus round which the wall forms, and eventually disappearing when the asci develop, these latter soon completely filling the ready-made cavity. The origin of the neck-canal was not determined, but it certainly takes place at a later period than the basal cavity. The asci when mature are cylindrico-clavate and attenuated below into a slender elongated base. They measure $90–100 \times 12–14\mu$. The spores are eight in number in an ascus, biseriate, sub-cylindrical with rounded ends, slightly curved, colourless, and triseptate at maturity, and measure $15–16 \times 5\mu$. Paraphyses scanty, linear, equal, aseptate, $80–100 \times 2\mu$.

The ascospores germinate in water within 12 hours, producing one or more germ tubes which elongate by apical growth, become septate and produce a few lateral branches; no further development was observed, the mycelium dying for want of nourishment. In a nutritive solution the spores germinate as described but growth is much more vigorous, and in about three weeks very minute pustules were formed by panicles of short, erect hyphæ, from the tips of which gonidia were cut off resembling in form and size those produced by the *Hainsea* form on living leaves. In the cultures, the stroma was rudimentary or entirely absent, but the gonidia germinated in a decoction of plums in a manner exactly similar to those obtained from the leaves, and also repeated themselves by budding, and there seems no room for doubt but that the gonidial form of reproduction produced by the germinating spores of the *Calospora* agree with *Hainsea* found on living vanilla leaves. The accuracy of the above statement was verified by the appearance of the *Hainsea* on living vanilla leaves obtained from the Royal Gardens about three weeks after being infected with *Calospora* spores. The leaf that produced the *Hainsea* was placed under a bell-jar with its base in water; another infected leaf suspended from the top of the same bell-jar yielded no result; from this it appears that *the presence of an excess of moisture in the leaf favours the development of the fungus.* The ascospores were placed on the uninjured upper surface of the leaves. The germ tubes of the *Calospora* enter the tissues of the leaf through the stomata, and the leaf is the only portion of the plant through which the parasite can gain access to the interior, as the stem and aerial roots are protected by a very thick, continuous cuticle; the growing points of the descending aerial roots are certainly tender and imperfectly protected, but I have not met with a plant attacked at these points. The production of the *Hainsea* from the *Calospora* closes the life-history of the fungus under consideration, although the proof from artificial cultures is not a complete sequence; for instance, the *Hainsea* stage could not be made to give origin to the *Cytispora* form, nevertheless the cycle has been completely proved as follows: the perithecia of the *Calospora* has been shown to originate from the stroma of the *Cytispora*, and the *Hainsea* has been produced from the germinating spores of *Calospora*.

## Summary.

The above account shows that healthy vanilla plants can be killed by a microscopic fungus which may be called *Calospora vanillæ* in the following manner.

The earliest form of the pleomorphic fungus, the *Hainsea* form, attacks the living leaves, and by means of its spreading mycelium destroys their tissues, thereby causing the death of the plant by destroying those organs on which the plant depends for an indispensable portion of its food, as also for the regulation of the amount of water contained therein. The death of the individual plant is caused entirely by the *Hainsea* form of the fungus, as the *Cytispora* and *Calospora* forms only appear when the leaf is already killed. The statement that the tips of the "pods" or capsules and of the aerial roots first show symptoms of disease, although not scientifically correct, is quite in harmony with the above statements, for although the leaves are first attacked, and consequently first diseased, yet the mycelium of the fungus remains in the tissues for some weeks before it bursts through the cuticle to liberate its gonidia or reproductive organs, but during the interval between the first entrance of the fungus into the leaf and its reappearance on the surface in the mature condition, its mycelium has disorganised the tissues, thereby preventing the performance of those functions already stated, and consequently rapidly growing portions of the plant as young fruits and aerial roots, first show symptoms of disease at the tips on account of their being farthest from the source of food supply, and would probably show external signs of disease even before the leaves themselves.

## Preventive Measures.

It is impossible to suggest remedies for the probable various causes of the vanilla disease without a thorough investigation of all the circumstances, conducted on the spot; yet assuming that the most important factor in causing the disease is the fungus already described, it would appear that ordinary precautions on the part of the cultivator, by taking advantage of the weak point in the sequence of development of the parasite, would soon result in its total disappearance. It must be remembered that the *Hainsea* form which appears on the living leaves and does all the mischief, cannot reproduce itself directly on other living leaves, but is followed at a later stage on the dying leaves; that is, the *Hainsea* mycelium produces another kind of fruit on the dying leaves, the *Cytispora* form, which possesses the power of reproducing its own form for probably several generations on dying leaves; eventually, when the leaf is quite dead, the masses of mycelium or stromata that produced *Cytispora* gonidia now give origin to the third or *Calospora* form, and when it is remembered that the *Calospora* spores *produced only on dead leaves*—can alone reproduce the *Hainsea* form on living leaves, it follows that *if all fading and dead leaves are destroyed by burning*, the fungus pest would soon disappear, or be at least so reduced as to produce no appreciable damage. Judging from the abundant supply of dead leaves literally teeming with the *Cytispora* and *Calospora* forms of the fungus that were forwarded with the material for investigation, it may be presumed that large quantities of leaves in a similar condition are lying about in the vanilla plots. If such is the case they should at once be burnt, as I venture once more on repeating the statement that *the continuance of the disease depends entirely on the presence of such diseased dead leaves.* The fact that the appearance

of the disease in the Seychelles islands is of recent date suggests the idea that impaired vitality of the vanilla plants may favour the spread of the disease. It is not known whether vigorous growing vanilla plants can be infected; it is almost certain that weakly specimens would be more susceptible. Direct proof of this could only be obtained on the spot, but the statement accompanying the material, that the disease was most prevalent in flat damp places where the drainage was insufficient, favours this idea. The development of the *Calospora* condition on the dead leaves depends entirely on moisture; if the leaves remain dry no growth takes place, but the mycelium or stromata remain quiescent, and judging from analogy can remain in this condition for a considerable length of time, and on being moistened resume their activity. In like manner it is probable that the mycelium of the *Hainsea* stage in the living tissues may under certain conditions remain for a considerable time in the leaves and stem without showing itself externally; hence it would be highly imprudent to use even apparently healthy plants obtained from infected areas for stocking new estates.

In conclusion it may be stated that the above described vanilla disease is not confined to Mauritius, the Seychelles, and Réunion islands; specimens of *Vanilla planifolia* were received at Kew in 1886 from Antigua, New Granada, showing all three forms of the fungus; the *Hainsea*, not known at that time to be a form-species, was described as *Glœosporium vanillæ*, Cke. and Mass., in *Grevillea*, vol. 15, p. 18.

Since the above was written all the stages of the above-described disease have been followed on cultivated orchids at Kew, belonging to the genera *Oncidium* and *Dendrobium*.

George Massee.

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## Explanation of the Plate.

Fig. I. Portions of stem, leaf, and aerial root of *Vanilla planifolia*, showing the *Cytispora* and *Calospora* stages of disease; nat. size.

Fig. II. Section through a pustule of the *Hainsea* stage of the disease; × 300.

Fig. III. *Hainsea* gonidia germinating; × 400.

Fig. IV. Secondary gonidia of *Hainsea* reproducing themselves by budding; × 400.

Fig. V. Section through pycnidia and portion of stroma of the *Cytispora* form; *a*, *a'*, stroma; *b*, *b'*, *b''*, pycnidia in various stages of development; × 250.

Fig. VI. Section through perithecia and portion of stroma of *Calospora vanillæ*; *a*, *a'*, stroma; *b*, *b'*, *b''*, perithecia in various stages of development; × 250.

Fig. VII. Ascus containing spores and paraphyses of the same; × 400.

## CCXLIV.—BOTANY OF MILANJI IN NYASSA-LAND.

In the *Kew Bulletin*, 1891, p. 183, an account was given of a journey made on the frontier of the British Protectorate of Nyassa-land in central tropical Africa, by Mr. John Buchanan, C.M.G., the Acting-Consul. One of the most striking features of Nyassa-land is the range of somewhat precipitous mountains occupying a commanding position to the south of Lake Nyassa and giving rise to numerous tributaries of the Zambesi river.

Recently these Milanji mountains have been visited by Mr. Alexander Whyte, a naturalist attached to the staff of Mr. H. H. Johnston, C.B., Her Majesty's Commissioner and Consul-General for the territories under British influence to the North of the Zambesi. A report of Mr. Whyte's journey is given in the "Papers relative to the Suppression of Slave-raiding in Nyassa-land, Africa," No. 5 (1892), presented to Parliament, June 1892. The following extracts contain references to the plants of the districts visited. Mr. Whyte's botanical collections have not yet been critically examined in this country.

### Mr. Whyte to Commissioner Johnston.

The Residency, Zomba, British Central Africa,
November 18, 1891.

Having returned from exploring and collecting specimens of the flora and fauna of the mountain and district of Milanji, I have now the honour to hand you my Report on the same.

Milanji is an isolated range of, for the most part, precipitous mountains, the main mass forming a huge natural fortress of weather-worn precipices, or very steep rocky ascents, sparsely clothed with vegetation. Many of its gullies and ravines are well wooded, and in some of them fine examples of grand African virgin forest are met with. The route by which I ascended the mountain from the plain, on the 20th October, led up from its south-east face, and at first zig-zagged over steep, grassy hills, down precipitous gorges, and across rocky streams, with beds of large water-worn granite boulders, which, when flooded, become impassable mountain torrents. Further on the ascent became more difficult, and I clambered over precipices, holding on by tufts of grass, roots, and scrub, which gave but slender support and scanty foot-hold. Once round these precipitous bluffs an interesting wooded gorge was entered, still steep and difficult, but with better foot-hold on the projecting rocks and tree-roots; and most welcome was the kindly shade after hours of toil in a burning sun, rendered doubly fierce by the reflection from the scorching hot rocks.

Here, too, an interesting change in the vegetation was at once perceptible, plants of the lower slopes being mostly replaced by species new to me, and in many instances approaching the flora of temperate climes, such as brambles and well known old forms of papilionaceous and composite plants. Ferns, too, became more numerous, and now and again we scrambled through perfect fairy dells of mosses, fern-fronds, selaginellas, and balsams, with miniature waterfalls showering their life-giving spray on the little verdant glades, while overhead hoary lichens and bright festoons of elegant, long-tasselled lycopods hung from the moss-covered ancient-looking trees. Up and up we climbed the apparently endless ladder of roots and rocks. Then we passed

through a dense thicket of bamboo, and again found ourselves confronted by an ugly barrier of precipitous cliffs, which were duly surmounted with the friendly aid of tufts of tussock-grass, which firmly adhered to the crevices of the rocks. Another hour's climb up a steep, grassy glen, brought us to the crest of the highest ridge, the sky-line of which we had so long sought to reach.

Here the scene spread out to view, and the climate were such, as fully to repay us for our day of weary toil. Looking westward, we saw mapped out beneath us the plateau or basin of Milanji, with its rolling hills of grassy sward, its clearly defined belts of dark green forest, and its numerous ravines and rivulets, all shaping their course towards the principal valley of the plateau, through which the Lutshenya, the main stream, flows. The climate here was delightfully cool and bracing. During the forenoon, on the lower ridges of the mountains, at over 4,000 feet lower than this point, we had sweltered in a stifling heat of 106 degrees Fahrenheit in the shade; while here we revelled in a clear, dry, health-restoring atmosphere of 60 degrees Fahrenheit. From this ridge, which forms one of the amphitheatre of hills surrounding the plateau or crater-like basin of Milanji, a good idea of the mountain system is gained. Still looking towards the west, we have on the right hand the main peaks of the mountain, rising directly from the valley of the Lutshenya, which runs parallel with its southern base, the height of one of the two summit peaks having been calculated at 9,300 feet above sea-level. Across the table-land, in the distance, is the somewhat isolated and precipitous Tshambi range, which, with its own smaller plateau, is separated from Milanji table-land by the rocky valley and gorge of the Likabula River. To the front and to the left hand, we have a continuation of the rolling and grassy hills which encircle the plateau, and which are capped with rugged cliffs of scarped granite and gneiss rocks.

Altogether I spent two weeks on the plateau changing to three different sites, each distant from 5 to 7 miles from the other, and this enabled me to explore more thoroughly this new and interesting mountain country. Unfortunately, the rains and mists set in before I left, and, consequently, we had only nine good collecting days.

The flora of the mountain proved to be most interesting, the species met with being mostly distinct from those of the plain or even the lower slopes. But, under this heading, I must first attempt to give a short description of the cypresses—the most striking botanical feature of the plateau. The remnant left of these fine conifers is confined to a few of the upper ravines and valleys, the largest forest of them finding a comparatively secure habitat in the damp gorges of the Lutshenya valley. A few old scorched monarchs of the glen lead a precarious existence pretty well up the southern slopes of the main mountain, but unless steps are taken to protect them* these interesting relics of the past are doomed to speedy destruction. It is deplorable to witness the devastating effects of the annual bush fires, from which even this lofty and all but inaccessible retreat is not exempt. During the dry months of August and September these fires, originating from the villages on the lower slopes of the mountain, gradually creep up the precipitous cliffs from tuft to tuft of grass until at last they reach the grassy plateau. Once there, the work of destruction is rapid. The fire rages over the table-land and eats its way along the edges of the remaining belts of forest, thus annually scorching, if not burning, the

* Steps have been ta'-en—H H. J.

bark and timber of the outside trees, and killing outright the young seedlings. In exceptionally dry seasons it appears that these fires have even penetrated some of the damp forests, and hundreds of giant cypresses lay prostrate and piled on each other in all stages of destruction, but generally consumed right through at the base of the tree. I measured several of these dead conifers, and one (by no means the largest to be met with) was 140 feet in length and 5½ feet in diameter at 6 feet from its base, and with a clear straight stem of 90 feet in length. The cones of this species of cypress (which may be new to science) are somewhat smaller than a chestnut of the same shape, *i.e.*, longer than broad, and open into four scales or segments, each having a spur-like knob at its apex, and covering five or six winged seeds. The foliage is of the usual juniper-like description, and the timber is of a dull reddish white colour, of excellent quality and easily worked. The bark on old trees is of great thickness, consisting of layers annually shed and renewed. I selected sections of this valuable timber tree, which I hope to send home with the other Milanji specimens by an early date. Seeds of it are put in nursery beds in the Residency experimental gardens at Zomba, and I trust the tree will thrive in its new habitat here. One or two other species of *Cupressus* were met with, but of dwarf and scrubby growth.

Tree-ferns attain to a great size in the damp, shady forests of the plateau, and one I measured was 30 feet in height and 2 feet in diameter at its base. I hope to send home sections of them also.

Never before have I met with more gorgeous displays of wild flowers than those to be seen in some favoured nooks of these highlands. There we observed creamy-white and yellow helichrysums, mingling with purple and blue orchids and irises, and graceful snow-white anemones, all blooming in wild profusion, and rearing their heads from a bed of bright green grassy sward—a floral carpet, which Nature alone can fashion. Altogether we procured several thousand specimens of dried plants of many species, and which, I trust, will be of benefit to science. Many of the trees had not come into flower, and the ferns had not matured their fronds and seeds. The grass lands also had been too recently burned to permit of many of the plants reaching the flowering stage.

The year is pretty equally divided into wet and dry months, the former being from November to May. The other six months are fine, clear, and bracing, the thermometer, at night, occasionally falling below freezing point in the months of May, June, and July. I found the air delightfully pure, balmy, and bracing during October, and a good idea of the temperature will be got from the register kept on the plateau, a copy of which I enclose. During the wet months, as at all mountain sanataria in the tropics, it must be miserable and dreary. At Newera Eliya, in Ceylon, I have known a whole week to pass without a ray of sunshine; mist and rain, all the while, driving over the plain. The one great drawback to the establishing of a sanatarium at Milanji is the great difficulty in reaching it, and, in fact, it is at present quite beyond the reach of invalids. With good engineering, however, a road could be made, of fairly good gradient, viâ the Lutshenya valley, and which would also serve as an outlet for the valuable cypress timber, now lying useless and decaying in the forests.

The soil of the grass lands is of the same poor description as is generally found in tropical countries at a similar elevation, which have been subjected to the same impoverishing effects of periodical fires. They are, consequently, unsuitable for cultivation, but would be admirably adapted for cattle or sheep runs, the prevailing grasses being more

tender and nutritious than the strong rank herbage of the plains. The climate, too, would be all in favour of stock-rearing, as would also be the well-watered nature of the valleys.

As to the soil around the base of the mountain, I consider it specially well suited for the cultivation of coffee, and cacao would do well in many of the sheltered ravines along the courses of the rivers. The land generally is remarkably productive, and some gardens were pointed out to me from which the natives had reaped three crops of Indian corn and sorghum within twelve months. The total rainfall is not great, probably from 60 to 70 inches, but it would seem to be better distributed than at Zomba and other ranges in the Shiré highlands. Mr. Brown, the pioneer planter of the district, in charge of the African Lakes Company's property, informed me that during his one year's experience there had not been a single month without rain. On the plains, tobacco and cotton could be grown to an unlimited extent, and, I have no doubt, at a good profit, when better means of transport are available. Many other minor tropica products could also be raised with advantage.

(Signed) ALEXANDER WHYTE.

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## MILANJI PLATEAU.

Weather Report, 6,000 feet above sea-level.—14 days.

| Date. | 6 A.M. | 12 A.M. | 6 P.M. | Remarks. |
|---|---|---|---|---|
| | Degrees. | Degrees. | Degrees. | |
| Oct. 21 - | 56 | 61 | 60 | Calm, sunny. Wind slight, S.E. |
| ,, 22 - | 56 | 62 | 61 | Calm, sunny. Wind slight, N.E. |
| ,, 23 - | 58 | 65 | 63 | Strong wind at night. Thunder. |
| ,, 24 - | 60 | 66 | 64 | Calm. |
| ,, 25 - | 59 | 68 | 63 | No wind. Cloudy. |
| ,, 26 - | 58 | 69 | 64 | No wind. Calm. No clouds. |
| ,, 27 - | 60 | 67 | 64 | No wind. Calm. Cloudy. |
| ,, 28 - | 61 | 66 | 62 | Camp No. 2. at 12 A.M., 500 feet elevation above Camp No. 1. Slight rain at 7 P.M. |
| ,, 29 - | 59 | 70 | 58 | Warm. Slight wind. |
| ,, 30 - | 56 | 70 | 59 | Camp No. 3. at 12 A.M., 300 feet elevation above Camp No. 2. Very foggy all afternoon. |
| ,, 31 - | 52 | 68 | 56 | Thick mist all day. Slight rain evening. |
| Nov. 1 - | 54 | 66 | 54 | Thick mist all day. Cold at night and morning. |
| ,, 2 - | 53 | 70 | 59 | Clear fine day. Camp No. 1. 12 A.M. |
| ,, 3 - | 56 | 76 | 64 | Clear fine day. Camp No. 1. Very hot. |
| | | | | Sunny, 9 days; rain, — days; misty, 3 days; cloudy, 2 days. |

Maximum, 67·5 degrees. Minimum, 58·5 degrees. Mean temperature, 63 degrees.

*Note.*—Readings, camps Nos. 2 and 3, in tent; rest in cool, damp house. Temperature at 2,300 feet above sea on 5th November, 6 A.M. 76 degrees.

(Signed) A. WHYTE.

November 5, 1891.

# CCXLV.—DECADES KEWENSES.

## PLANTARUM NOVARUM in HERBARIO HORTI REGII CONSERVATARUM.

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## DECAS II.

11. **Hansemannia oblonga,** *Hemsl.* [Leguminosæ-Mimoseæ]; foliis bipinnatis pinnis unijugis, foliolis oblongis, racemis elongatis terminalibus

*Arbor* elegans (*Comins*), novellis ferrugineo-pubescentibus. *Folia* breviter petiolata (petiolus fere bipollicaris); foliola 4-juga, brevissime petiolulata, tenuissima, fere membranacea, cito glabrescentia, anguste oblonga, acuta, maxima semipedalia et fere 2 poll. lata (inferiora gradatim minora, infima vix bipollicaria), venis primariis inconspicuis, venulis ultimis reticulatis. *Racemi* cum pedunculo brevi circiter 8 poll. longi, densiflori, pedicellis 3–4 lineas longis. *Flores* aurantiaci (*Comins*), 9–10 lineas diametro; calyx crassus, subcoriaceus, ferrugineo-tomentosus, sæpius alte trilobatus, lobis latis fere rotundatis; corolla semipollicaris, subcoriacea, regularis, 4-lobata, extus albo-tomentosa, lobis ovato-lanceolatis vix acutis; stamina numerosissima, petala superantia; gynæcii carpella 3–5, subsessilia, pauciovulata, dense villosa, stylis gracilibus glabris quam stamina longioribus. *Legumen* ignotum.

*Hab.*—Malanta, Solomon Islands, *Rev. R. B. Comins*, 102.

The pluricarpellary genera of the Mimoseæ should probably all rank as sections of other genera, but it is difficult to decide their limits, and so long as one is maintained, the others must be. Bentham (Trans. Linn. Soc., xxx., p. 349) suggests that the Australian *Archidendron*, F. von Muell, would be better placed as a section of *Pithecolobium*, and the Brazilian *Affonsea*, St. Hil., as a section of *Inga*; whereas Mueller himself (Second Census of Australian Plants, p. 80) reduces *Archidendron* and half-a-dozen other genera to *Albizzia*. Kuntze (Rev. Gen. Pl., p. 158) reduces *Archidendron* to *Affonsea*. In the meantime Schumann established (Engler's Jahrbücher, ix., p. 201) his *Hansemannia*, which differs from *Archidendron* in having racemose instead of capitate flowers. Under these circumstances I prefer the course here adopted.

12. **Oxyanthus Monteiroæ,** *N. E. Brown* [Rubiaceæ]; frutex ramulis stipulis foliisque subtus pubescentibus, foliis breviter petiolatis oblongis breviter et subrepentino acuminatis, basi oblique cordatis, coriaceis supra glabris, venis primariis 8–9 costæ utrinque, stipulis late triangulari-ovatis acuminatis, floribus in paniculis axillaribus brevibus glabris brevissimo pedunculatis multifloris congestis, bracteis lanceolato-subulatis acuminatis dorso pubescentibus, calyce quinquedentato, corolla alba, tubo gracili, lobis lanceolatis acuminatis tubo octuplo brevioribus.—Monteiro, "Delagoa Bay," pp. 1 et 201.

*Hab.*—Delagoa Bay, *Mrs. Monteiro.*

*Folia* circa 3 poll. longa, $1\frac{1}{2}$–$1\frac{3}{4}$ lata, petioli $\frac{1}{4}$ poll. longi. *Stipulæ* 4–5 lin. longæ. *Calycis* dentes $\frac{1}{2}$ lin. longi. *Corollæ* tubus 2 poll. longus, lobi $\frac{3}{8}$ poll. longi.

This is very distinct in foliage from the other known species of the genus, but in its flowers and congested panicles resembles *O. Gerrardi*, Sond.

13. **Pachypodium Saundersii,** *N. E. Brown* [Apocynaceæ]; frutex succulentus caudice magno napiformi, ramis valde aculeatis glabris, foliis subsessilibus obovatis vel obovato-ellipticis subacutis, marginibus aspero-denticulatis, costa hirta excepta utrinque glabris, stipulis aculeiformibus rectis, cymis sessilibus plurifloris ad fasciculos redactis, calycis lobis late ovatis acuminatis, corolla alba roseo tincta, tubo infra medium abrupte angustato, intus piloso, lobis oblique rhomboideis acutisque.

*Hab.*—South Africa: South-east Bombo range of mountains, in very stony places. *Saunders.*

*Rami* 4–5 ped. longi. *Folia* $1\frac{1}{2}$–3 poll. longa, $\frac{3}{4}$–$1\frac{1}{2}$ poll. lata. *Stipulæ (aculei)* $\frac{1}{4}$–$1\frac{1}{2}$ poll. longa. *Calycis* lobi $\frac{1}{8}$ poll. longi. *Corollæ* tubus $1\frac{1}{4}$–$1\frac{1}{2}$ poll. longus, limbo 2–$2\frac{1}{2}$ poll. diam.

This very distinct species was discovered by Mr. Charles Saunders, and forwarded to Kew by Mrs. K. Saunders, with the following extract from her son's letter concerning it:—"I came upon a most peculiar plant when first we came here, not then in flower. Now it has a very pretty and delicate white bloom just like wax, each petal tinged with a delicate pink. It grows among the stones, and just above the ground forms a large kind of ball-shaped stem. From that it throws out branches covered with thorns about an inch long, some of the shrubs growing about four or five feet high. The stems are very succulent, like a geranium." The exact locality is not stated, so whether it grows on the Zululand and Amatonga side or the Swaziland side of the range is uncertain.

14. **Strophanthus petersianus,** Klotzsch, var. *grandiflorus, N. E. Brown* [Apocynaceæ]; foliis et floribus multo majoribus ab typo tantum differt.—Monteiro, "Delagoa Bay," pp. 47 et 164.

*Hab.*—Rises north side of Limpopo River, *Erskine*: Delagoa Bay, *Mrs. Monteiro*, 1: Zanzibar, *Dr. Kirk*: Mombasa, *Hildebrandt*, 1976.

*Folia* $1\frac{1}{2}$–3 poll. longa $\frac{3}{4}$–2 poll. lata; petioli $\frac{3}{8}$ poll longi. *Calycis* segmenta $\frac{1}{2}$ poll. longa. *Corollæ* tubus ampliatus 1 poll. longus et latus; lobis 5–7 poll. longis, reflexis.

I can find no characters to distinguish this plant from the typical *S. petersianus*, except the larger leaves and flowers, and these differences are possibly due to the greater humidity of the coast region where this variety grows, the typical form being a native of the inland region at Tette. It is interesting in having such an extensive range, the northern and southern localities being 20 degrees of latitude apart. When in flower it must be very ornamental and well worth cultivating; the label on Mrs. Monteiro's specimen states that it "grows in the thick scrub, with long branches, forming dense bushes 5 to 6 ft. high. Flowers white inside, maroon outside." A sketch in the Kew Herbarium represents the flowers as purple outside and white within, marked with some orange lines in the tube. The flowers stand erect, the lobes of the corolla being reflexed and their long slender tails pendulous. A second variety (var. *amboensis*) is described by Dr. Schinz in *Verhandlungen Bot. Ver. Prov. Brandenburg*, 1889, vol. 30, p. 259, from Amboland, on the western side of the continent.

15. **Hoya affinis,** *Hemsl.* [Asclepiadeæ]; *H. Guppyi* arcte affinis, differt foliis oblongis paucinervis, petiolis crassioribus, floribus majoribus intus fere glabris extus pubescentibus.

*Rami* subcarnosi, parcissime puberuli, cito glabrescentes. *Folia* carnosa, longe petiolata, oblonga vel elliptica, absque petiolo 3–4 poll. longa, breviter acuminata, basi rotundata, nitida, supra secus costam primum parce puberula; petiolus crassissimus, 12–15 lineas longus. *Flores* subumbellati, fere 1½ poll. diametro, umbellis paucifloris axillaribus breviter pedunculatis, pedicellis graciliusculis circiter sesquipollicaribus; sepala parva, ovato-oblonga, subobtusa, extus pubescentia; corolla crassa, carnosa, rotata, extus puberula, lobis deltoideis patentissimis; coronæ squamæ cartilagineæ vel fere crustaceæ, nitidæ, ovoideæ. *Folliculi* desunt.

*Hab.*—Florida, Solomon Islands, *Rev. R. B. Comins*, 57.

16. **Clerodendron congense**, *Baker* [Verbenaceæ]; fruticosum, erectum, ramulis gracilibus glabris, foliis oppositis brevissime petiolatis oblongis vel obovatis integris cuspidatis glabris, floribus pluribus in cymis congestis terminalibus globosis pedunculatis aggregatis, calycis glabri segmentis ovatis tubo oblongo brevioribus, corollæ tubo cylindrico glabro recto calyce multo longiori, lobis obovatis parvis subequalibus, staminibus lobis triplo longioribus.

*Hab.*—Congo Free State: Banks of the river below Stanley Pool, *H. H. Johnston.*

*Folia* 4–6 poll. longa. *Calyx* 2 lin. longus. *Corollæ* tubus 12–15 lin. longus; segmenta 2 lin. longa. *Filamenta* 6–8 lin. longa, antheris parvis.

This fine species, one of the first fruits of the botany of the Congo Free State, is nearly allied to *C. sinuatum*, Hook., in Bot. Mag., t. 4255, a plant of Sierra Leone. The colour of the flower is probably white. The expanded heads are four inches in diameter.

17. **Eulophia dispersa**, *N. E. Brown* [Orchideæ]; foliis lineari-lanceolatis acutis; scapo vaginis 2–4 ovatis acutis distantibus instructo; bracteis lanceolato-subulatis; floribus numerosis speciosis luteis, sepalis ovatis acutis valde reflexis, petalis multo majoribus ellipticis obtusis, labello hastato-oblongo obtuso, breviter calcarato, disco distincte tricarinato cum carinis 2–3 minus elevatis utrinque.—Monteiro, "Delagoa Bay," p. 174 and figure on title page.

*Hab.*—Delagoa Bay, *Mrs. Monteiro*: Shupanga, Zambesi Expedition, *Dr. Kirk*: Moramballa, Livingston's S. African Expedition, *Dr. Kirk*: Banks of Zonga River near Lake Ngami, *McCabe*: Ribe, *Rev. T. Wakefield*: Zanzibar, *Dr. Kirk*: Lake Nyassa.

Folia 1½–2 ped. longa, ⅝–1 poll. lata. Scapus 2–4 ped. altus, vaginis 1–1¾ poll. longis. Flores 2 poll. diam.; sepalis ⅞ poll. longis, petalis ¾–1 poll. longis, ½–¾ poll. latis, labello ¾–1 poll. longo, ⅜–½ poll. lato, calcare ⅛–¼ poll. longo.

This plant is allied to *E. speciosa*, but differs in being less stout in habit, with narrower bracts, and especially in having well marked keels on the lip. Mrs. Monteiro describes the flowers as "yellow with white centre streaked with crimson, sweet scented." A coloured sketch from Dr. Kirk represents the flower as yellow with orange keels. Probably the flowers vary in colour, as is the case in some other species of this genus. I can find no difference in the flowers themselves from the different localities mentioned.

18. **Pseudomacodes**, *Rolfe* [Orchidearum Genus Novum]. Sepala subæquali, libera, patentia. Petala argusta, cum sepalo postico in galeam conniventia. Labellum basi columnæ adnatum, late ventricosum, intus

bicallosum; lobi laterales parvi, erecti; lobus medius unguiculatus, ungue crenulato, lamina parva ovato-rotundata. Columna brevis, antice sub stigmate in laminam tenuem producta; stigma carnosa, sub rostello elongato bifido prominens; clinandrium membranaceum, cum rostello in cyathum connatum. Anthera acuminata, loculis contiguis sed vere discretis; pollinia sectilia, anthera dehiscente stipiti brevi a glandula parva affixo.

**P. Cominsii,** *Rolfe*, terrestris, foliata, rhizomata repente, habitu *Anœctochili*. Folia late elliptico-ovata, breviter acuminata, insigniter venoso-picta, 2–4½ poll. longa, 1–3 poll. lata, petiolus 1–4 poll. longus. Scapus erectus, pubescens, circa pedem longus, racemo elongato multifloro. Sepala late ovato-oblonga, subobtusa, fere 3 lin. longa, 2 lin. lata. Petala linearia, quam sepala paullo breviora. Labellum fere 3 lin. longum, basi subgloboso-ventricosum.

*Hab.*—San Cristoval, Solomon Isles, *Rev. R. B. Comins*, 116. "Low plant, very succulent, handsome, leaves red and green. Native name 'Kanora.'" Colour of flowers not recorded.

A new genus with the habit and general appearance of *Macodes*, Blume, but differing therefrom in its large fleshy stigma, and in the possession of a large and thin plate-like appendage in front of the column, instead of a pair of parallel ones, in which latter respect it differs from every one of the allied genera, so far as I can ascertain. Moreover in *Macodes* these appendages descend into the sac of the lip, somewhat as in *Dossinia*.

19. **Amomum (Achasma) Ridleyi,** *Baker* [Scitamineæ]; caule foliifero robusto longissimo foliis sessilibus oblongis basi rotundatis, florum capitulis subsessilibus oblongis, bracteis oblongis, corollæ tubo cylindrico bracteis æquilongo, segmentis parvis lingulatis rubris, stamina corollæ segmentis vix breviori antherâ magna lineari hirsuta.

*Hab.*—Singapore, *Ridley* 96 !

*Caulis* foliiferus 10-pedalis et ultra. *Folia* 15–18 poll. longa, 3–4 poll. lata. *Bracteæ* 2 poll. longæ. *Corollæ* segmenta 8–9 lin. longa.

Ab Griffithii speciebus tribus cognitis differt corollæ lobis multo minoribus.

20. **Æchmea (Platyæchmea) Nichollsii,** *Baker* [Bromeliaceæ]; foliis loratis subcoriaceis apice rotundatis mucronatis facie glabris dorso tenuiter lepidotis aculeis marginalibus parvis crebris ascendentibus, pedunculo elongato, floribus spicato-paniculatis, bracteis primariis parvis lanceolatis reflexis, spicis distichis pedunculatis, bracteis floriferis geminis, exteriori oblongo-naviculari, interiori breviori ad axin adnato, sepalis coriaceis minute cuspidatis, petalorum laminis parvis.

*Hab.*—Island of Tobago, on trees in the woods, *Dr. H. A. Alford Nicholls.*

*Folia* bipedalia, medio 2 poll. lata, basi dilatata oblonga 8 poll. longa, 4 poll. lata. *Spicæ* 3–4 poll. longæ, 1 poll. latæ. *Calyx* 1 poll. longus.

Habitus *Æ. lingulatæ*, Baker (*Bromelia lingulata*, Linn), sed spicis distichis longioribus distincte pedunculatis.

## CCXLVI.—SANSEVIERIA FIBRE FROM SOMALI-LAND.

(*Sansevieria Ehrhenbergii*, Schwein.)

The increased attention devoted to the production of white rope fibres in the Western tropics appears to have had a stimulating effect also in the East Indies. The production of fibre from *Agave vivipara* in Bombay and Manila is now followed by a fibre obtained from Somali-land from a singular species of *Sansevieria*. This fibre was first received in this country as an "Aloe" fibre. It was soon noticed, however, that it possessed characteristics differing from all ordinary "Aloe" fibre, and an inquiry made by this establishment through the Foreign Office has shown that it is one of the many so-called Bow-string Hemps, and probably yielded by *Sansevieria Ehrhenbergii*, a plant first collected by Dr. Schweinfurth, and of which little or nothing was known until it was described by Mr. J. G. Baker, F.R.S., in *Journal of the Linnean Society*, xiv. p. 549. Its locality is there stated as "between Athara and the Red Sea." The details in regard to its utilisation as a fibre plant are contained in the following correspondence :—

Royal Gardens, Kew, to Foreign Office.

Royal Gardens, Kew, March 29, 1892.

I am directed by Mr. Thiselton-Dyer to acknowledge the receipt of a copy of a Report on the Aloe Fibre of Somali-land, [Foreign Office Miscellaneous Series, No. 225, 1892,] communicated to this establishment.

2. This Report is of an interesting character. It would be desirable to obtain a small sample of the fibre for the Museums of Economic Botany at Kew.

It would be useful also to obtain a large leaf from the plant yielding the fibre and, if possible, a few small plants for growing in the Kew collection.

The leaf and young plants would travel very well in a dry box without any packing, and provided with holes in the sides for ventilation.

3. Mr. Thiselton-Dyer trusts that the Secretary of State will approve of the kind offices of Lieutenant-Colonel Stace being invited to obtain the specimens mentioned, and I am to add that this establishment will be prepared to pay any reasonable expenses that may be incurred.

I have, &c.
(Signed) D. Morris,
Assistant Director.

Sir Villiers Lister, K.C.M.G.,
Foreign Office.

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Sir E. Baring to the Marquis of Salisbury.

My Lord, Cairo, February 17, 1892.

I have the honour to forward herewith to your Lordship a Report by Lieutenant-Colonel E. V. Stace, Her Majesty's Consul at Aden, regarding the Aloe Fibre of the Somali Coast Protectorate.

I have, &c.
(Signed) E. Baring.

## Aloe Fibre in Somali-land.

### Lieutenant-Colonel E. V. Stace to Sir E. Baring.

Sir, Aden, January 31, 1892.

I have the honour to make the following report regarding the Aloe Fibre of the Somali Coast Protectorate, my object being that, should there be no objection, the subject might be brought to the notice of the various Chambers of Commerce in England, with a view to the possible development of a useful industry which would be beneficial to the people, and might be a source of revenue to the Government.

2. In November last a bale of the fibre was sent to the Government of Bombay. This was sent to England, and the reports have just been received. I must state here that the fibre was prepared in the roughest and rudest manner by ignorant Somalis in the manner described in the accompanying copy of a memorandum which I wrote on November 22nd last, yet the price obtained was, I think, a very fair one, and might be considerably increased if the fibre were properly prepared.

3. The report of the Bombay Company (Limited) on the fibre sent by the Government of Bombay states that it was sold at the rate of 16*l.* 10*s.* per ton. "Our London brokers valued the parcel at about the same "price, and it is pretty evident that in larger quantities this article "would meet with a ready sale." And again, "This fibre compares "favourably with the many new types we see from various countries, "which are frequently too poor in colour, or too short, brittle, and full "of pith. Yours is of good strength, very nice colour and length."

The brokers further reported the fibre "all very nice colour, and good "strength and clean . . . . . This seems a very saleable article if "once introduced."

4. I need scarcely say that the small quantity sent was very much against a better price being obtained; the sale was by auction of what was really but a sample.

5. There are vast quantities of the Aloe growing in Somali-land. The people themselves will do nothing towards making a trade in the fibre; indeed, they have not the means to work it profitably, though they use it extensively themselves for ropes and other articles. I have a specimen growing here (Aden) over 7 feet in length, though I admit that this is exceptional; still I am informed that the wild plant might be materially improved. I have no knowledge whatever myself on the subject, but I have thought that if the existence of the plant and value of the fibre be made known in England through the Chambers of Commerce, it is possible that some persons with experience might be induced to make the necessary inquiries regarding a profitable production of the fibre.

I have, &c.
(Signed) E. V. Stace.

P.S.—The specimen mentioned in paragraph 3 of the attached memorandum, as "sent to England," was merely a small hand-parcel. The larger parcel sent through the Government of Bombay was the one reported on by the brokers, as mentioned in this letter above.

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### Memorandum regarding the Aloe Fibre of Somali-land.

The following is gathered from various sources in England and Somali-land. I have never seen the fibre prepared myself.

2. The plant is not cut, it is pulled out of the ground—the sharp points are cut off; the plant is then divided in two down the centre; the pieces are then beaten with a stick until they become soft. The fibre is then extracted by placing the divided plant between two pieces of wood, which are fastened tightly together, and the plant is pulled through them, leaving the fibre. This is then placed in the sun to dry for about half an hour. No water is used; the Somalis say that that blackens the fibre. The plant should be treated as soon as possible after being pulled up to prevent the drying of the sap.

3. Regarding a specimen of the fibre sent to England (similar to that sent to Bombay), it was considered that the fibre should be whiter, and that it was rather short; but that any quantity of the same as sent would be well received, and it was valued at 21*l.* to 22*l.* per ton. It wanted more bleaching in the sun and washing in water, and should be well cleaned.

Death's patent fibre cleaning machine costs about 70*l.*; it requires either water-power or a 5 horse-power steam-engine of English make to drive it; this costs 150*l.*

If the aloe is left lying for a day or two in the sun it ruins it; it should be treated at once, and under sheds.

4. I know of no water-power within any reasonable distance of the coast.

5. There appears to be any amount of aloe within reasonable distance. I have heard that it would be much improved by being properly cultivated, such as thinned in places where it is growing too thickly.

6. Labour is obtainable at the seaport towns, but the Somali is extremely lazy, and it might be necessary to import Arab labourers at first, though regular employment for the Somalis, who swarm as idlers about the ports, would be very desirable.

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## Royal Gardens, Kew, to Foreign Office.

Sir, Royal Gardens, Kew, June 27, 1892.

I am desired by Mr. Thiselton-Dyer to inform you, in reference to my letter of the 29th March last, that a case containing young plants, stems, leaves and fibre from Somali-land has been received at Kew from Lieutenant-Colonel E. V. Stace, C.B., Political Agent and Consul at Aden.

The specimens arrived in excellent order, and they have enabled us to determine very readily that the plant yielding the new fibre from Somali-land is not an "Aloe" or Agave like that yielding Bombay Aloe fibre. The plant is a *Sansevieria*, one species of which (*Sansevieria zeylanica*) yields the well-known Bow-string hemp of India (*Kew Bulletin*, May 1887, pp. 1–11). The Somali-land plant is probably *Sansevieria Ehrhenbergii* of Schweinfurth, described in the *Journal of the Linnean Society*, vol. xiv. p. 549, and known only from very imperfect material. The leaves are stout and subcylindrical, terminating in a strong spine. They are solid throughout, and are 4 to 5 feet in length and, according to Lieutenant-Colonel Stace, under exceptional circumstances they attain a length of about 7 feet. The circumference of fresh leaves at the base would be about 5 to 7 inches. The flowers have not yet been received. The plant is altogether a very interesting one, and its existence as a source of a valuable supply of fibre is a fact that will be sure to awaken attention amongst commercial men in this country.

Mr. Thiselton-Dyer desires to express his thanks to the Secretary of State for the prompt manner in which his wishes have been met in this matter, and he would venture to ask that the obligations of Kew be conveyed to Lieutenant-Colonel Stace for the admirable way in which he forwarded the specimens to this country.

I have, &c.
(Signed) D. Morris,
Assistant Director.

Sir Villiers Lister, K.C.M.G.,
Foreign Office.

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Messrs. Ide and Christie, to Royal Gardens, Kew.

72, Mark Lane, London,
June 27, 1892.

Sir,

We duly received your favour of the 18th instant, accompanying a sample of fibre from a plant known as the "Aloe of Somali-land."

This is an excellent fibre of fair length, and with plenty of "life." In character it strongly resembles the best Sisal hemp, with which we should have classed it, but for your statement that it is derived from a *Sansevieria.*

With the exception of its colour, its preparation is perfect, and even as it is, we value it to-day at 25*l.* per ton. We are of opinion that if care were taken to improve the colour, a considerably higher price would be readily obtainable, perhaps as much as 50*l.* per ton, if a pure white fibre could be attained without loss of strength and lustre.

Yours, &c.
(Signed) Ide and Christie.

D. Morris, Esq., M.A., F.L.S.,
Royal Gardens, Kew.

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## CCXLVII.—PARAGUAY TEA.

(*Ilex paraguariensis*, St. Hil.)

The Paraguay tea or *Yerba de Maté* is one of the most important economic products of South America. There are several varieties and possibly more than one species of *Ilex* yielding this tea. The plants are found in Brazil and Paraguay, and they are extensively used by the whole population of South America. The active principle found in the leaves is the alkaloid known as caffein, identical with that found in tea and coffee. There is also, according to Dr. T. Cranstown Charles (who published a note on the subject in the *British Medical Journal*, July 1890, p. 203), a tannic acid present in large amount. Further, "although *maté* is closely allied to coffee, it yields up its active principle " in a different way, and it is slower than coffee in yielding up its " nutritious principles to boiling water."

In the preparation of *maté*, the leaves are scorched and dried while still attached to the branches brought in by the collectors, they are then beaten, separated, coarsely ground by rude mills, and packed in skins and leather bags. The leaves are infused in small tea-pots, and the tea is sucked through a bombilla or tube with wire net-work or perforations

at the bottom. The consumption of *maté* in South America is very extensive; upwards of five million pounds are exported from Paraguay alone.

The following notes on the botany of plants yielding Paraguay tea have been prepared by Mr. N. E. Brown, A.L.S., one of the assistants in the Kew Herbarium. They show that considerable confusion has arisen in regard to the identification of the original species described by St. Hilaire, and this confusion has extended to cultivated specimens grown in this country and elsewhere. Some of these have proved to be a species of *Symplocos* and another a species of *Elæodendron*. Mr. Brown's investigations will unable us to unravel some at least of the difficulties brought about by the writings of Miers, who, at the time, had not seen the type of St. Hilaire's species.

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## Notes on certain Plants yielding Paraguay Tea.

The question having arisen as to whether the plant cultivated at Kew, and probably elsewhere, under the name of "Paraguay Tea" was the true *Ilex paraguariensis* of St. Hilaire or some other species, has caused me to examine some of the South American species of Ilex, and to compare the Kew material with the types of D. Don and Miers, which are now preserved in the British Museum Herbarium; the following being the result of my investigations:—

When Miers wrote his account of the "Paraguay Tea" plants,* he had not seen the type of St. Hilaire's species, and states that it was either lost or mislaid in the Paris Herbarium; the latter would appear to have been the case, as a set of duplicates of St. Hilaire's collection has recently been received at Kew from the Paris Herbarium, and among them are two shoots of *Ilex paraguariensis*, St. Hil.! from the province of Minas Geraes. These prove to be specifically identical with the plant figured and described by Don as *Ilex paraquensis* in the appendix to Lambert's *Description of the genus Pinus*, as indeed is distinctly stated by St. Hilaire himself in his *Voyage dans le district des Diamans*, vol. 1, p. 273. On referring to Miers' types, I find that *I. paraguayensis*, vars. *dentata* and *usitata*, Miers, and *I. curitibensis*, var. *gardneriana*, Miers, also belong to this species, for between the three plants to which Miers applied these three names I can find absolutely no distinction except as to sex. St. Hilaire's specimens received at Kew are vigorous young shoots with very large leaves, and have neither flowers nor fruit, but there can be no question as to their identity with the specimens above mentioned; the toothing of the leaves varies considerably, one shoot having much more finely toothed leaves than the other shoot has; and from these and other specimens at Kew it is easy to see that the typical *I. curitibensis*, Miers, is a slight form of the same plant with the tips of the leaves a little more prolonged. Two leaves on one of St. Hilaire's specimens are very similar to the two lower ones represented on Miers' plate of *I. curitibensis*, and the foliage of the right-hand fruiting branch figured in Hooker's *London Journal of Botany*, 1842, vol. 1, t. 1, obtained from the Horticultural Society, as mentioned on p. 31 of the Journal, closely agrees with the smaller leaves of Miers' type of *I. curitibensis*, but the teeth are not quite so deeply cut; it

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* *Annals and Magazine of Natural History*, 3rd ser. vol. 8, p. 389; and *Contributions to Botany*, vol. 2, p. 99.

appears to me fairly intermediate between *I. paraguariensis* and *I. curitibensis*, and has leaves very similar to both forms on the same twig, so that I believe St. Hilaire was perfectly correct in considering the Curitiba and Paraguay plants to be one and the same species, although the quality of the tea prepared from each may be different, as stated by Miers. The left-hand branch (from Tweedie) figured on the plate in the *London Journal of Botany* just quoted, is a small leaved specimen of the true *I. paraguariensis.* The plant which Miers considered to be the type of the "real Paraguay species" (Bonpland, No. 596), I do not match with any specimen in the Kew Herbarium, but his type specimen is accurately represented on pl. 61 of his *Contributions to Botany ;* the leaves are nearly but not quite entire, the younger part of the stem is sparsely and minutely pubescent, a character not mentioned by Miers, and by which it differs from all his other specimens except *I. paraguayensis*, var. *idonea*, which also has pubescent shoots and petioles, and rather more oblong leaves ; the peduncles and pedicels too, of Miers' typical form, are very slender, just as represented on his plate. But although these differences may indicate a different variety, I think it probable that all are forms of but one species. Turning to the species described by Reisseck in the *Flora Brasiliensis*, I should place *I. domestica*, var. *glabra*, under typical *I. paraguariensis* ; his typical *I. domestica* (which is identical with *I. vestita*, Reiss.) is a very closely allied plant, differing in no respect except pubescence, so far as I can see, from *I. paraguariensis ;* and *I. sorbilis*, Reiss. I believe to be the same plant, but I have not seen an authentic specimen.

None of these forms are the same as the plant now cultivated at Kew as *Ilex paraguariensis*, that plant being *I. nigropunctata*, Miers, a perfectly distinct species, and more nearly allied to *I. affinis*, Gardn. than to *I. paraguariensis*, St. Hil.

Of the other species described by Miers as being used for Paraguay Tea, the following is the synonyny. *I. gigantea*, Bonpl. is the same as *I. fertilis* Reiss. and must give place to the latter name. *I. amara*, Bonpl. is *Symplocos lanceolata*, A. DC. ! It will be interesting to know if this plant really yields theine, but it is enumerated by Bonpland among the species employed for making Maté, see Miers *Contributions* vol. 2, p. 99. Miers' type is without flower or fruit, being a young vigorous twig with deeply toothed leaves. I at once recognised it as a species of *Symplocos*, and on looking at the Kew material found my identification fully confirmed by two leaves from a specimen sent by Bonpland to Prof. Muenter many years ago, and communicated to Kew by Dr. Goeze in 1882, with the following information :—" Some " twenty or thirty years ago M. Bonpland sent dried specimens of Ilices " to M. Muenter, out of which the Paraguay Tea is prepared. Amongst " others there is one plant which Bonpland called ' *Cauna de Campo*,' " and which according to Bonpland is on behalf of its beautiful yellow " colour, taken with preference for the *Yerva Maté*. Muenter believes " this not to be a true Ilex. Bonpland in his diagnosis says * * * " Here follows a description, concluding with "Crescit in montibus Sta. Cruz (Brazil)." This is the locality given by Bonpland for his *I. amara*, and the leaves sent to Kew by Dr. Goeze belong to the same plant, but are from a flowering shoot and less strongly toothed than in Miers' specimen, and certainly belong to *Symplocos lanceolata*, A. DC. A note on this plant will be found in Prof. Muenter's article on Maté plants, published in 1883 in *Mittheil. Naturwissensch. Ver. Neu-Vorpomm.* vol. 14, p. 203, or in the reprint, p. 101, but Prof. Muenter did not identify it with *Ilex amara*, Miers.

*I. humboldtiana*, Bonpl. is a perfectly distinct species from *I. paraguariensis*, of which Reisseck makes it a variety, and is not at all difficult to recognise.

*I. ovalifolia*, Bonpl. is very closely allied to *I. humboldtiana*, and may perhaps be a form of that species, but the leaves are shorter, and broader in proportion to their length.

The plant figured in the *Botanical Magazine*, t. 3992, as *Ilex paraguayensis* is clearly not an Ilex at all, but a member of the order *Celastrineæ*, but after going through the whole of the *Celastrinæ*, and the American species of Ilex contained in the Kew Herbarium, I have been unable to find a specimen of the plant figured, but I think it is most probably *Elæodendron quadrangulatum*, Reiss.

Set out in tabular form the synonyny of the Paraguay Tea plants discussed by Miers appears to be as follows :—

1. **Ilex paraguariensis**, *St. Hil. in Mem. Mus. Hist. Nat.* vol. 9, p. 351 (1822); *Spach, Hist. Nat. Veg. Phan.* vol. 2, p. 430, *Atlas* pl. 16; *Münter in Mittheil. Naturwiss. Ver. Neu-Vorpomm.* vol. 14, p. 181; and reprint, p. 79.

I. paraguensis, *Don in Append. to Lambert Descript. of the genus Pinus* t. 2 (1824); *Hook. Lond. Journ. Bot.* 1842, vol. 1, p. 35, t. 1.

I. mate, *St. Hil. Hist. Plant. remarq. Brésil et Parag. Introduct.* p. xli. (1824).

I. domestica, *Reiss. var.* glabra, *Reiss. in Fl. Bras.* vol. 11. part 1, p. 67 (Feb. 1861).

I. paraguayensis, *var.* dentata, *Miers*, and var. usitata, *Miers in Ann. and Mag. Nat. Hist.* 3rd ser. vol. 8, p. 392-393 (Nov. 1861); and *Contrib. Bot.* vol. 2, p. 102–103, pl. 62.

I. curitibensis, *Miers*, and *var.* gardneriana, *Miers in Ann. and Mag. Nat. Hist.* 3rd ser. vol. 8, p. 393–4; and *Contrib. Bot.* vol. 2, p. 103–104, pl. 63.

Paraguay: *Tweedie! Balansa! Bonpland!* R. Parana between 26° and 27° S. lat. *Paradi!* South Brazil: *Lobb* No. 34! *Sellow! Reidel!* Organ Mountains, *Gardner* No. 346! *Glaziou* No. 6123! Province of Minas Geraes, St. Hilaire, No. 785! Kew and British Museum Herb. A plant collected by *Regnell* at Caldas in the province of Minas Geraes (No. I. 50) I believe to be a northern form of this plant, the leaves are the same, but the very short flowering axis is pubescent and bears more flowers, it is distributed as "*I. sorbilis* Reiss?"

The following I believe to be merely pubescent forms of the typical *I. paraguariensis*, St. Hil.

*a*. I. vestita, *Reiss. in Fl. Bras.* vol. 11, part 1, p. 54, t. 12, f. 11.
I. domestica, *Reiss. in Fl. Bras.* vol. 11, part 1, p. 67, t. 14, f. 2.
I. sorbilis, *Reiss.? in Fl. Bras.* vol. 11, part 1, p. 66, t. 14, f. 1.

South Brazil: *Sellow! Morong* No. 636! Kew Herb.

*b*. I. paraguayensis, *Miers* and *var.* idonea, *Miers, in Ann. and Mag. Nat. Hist.* 3rd ser. vol. 8, p. 391–392; and *Contrib. Bot.* vol. 2, p. 101–102, pl. 61.

I. bonplandiana, *Münt. in Mittheil. Naturwiss. Ver. Neu-Vorpomm*, vol. 14, p. 183, t. 1, f. 1 and 3–8; and reprint, p. 81.

I. theæzans, *Bonpl. ex Miers in Ann. and Mag. Nat. Hist.* 3rd ser. vol. 8, p. 389 and 391; and *Contrib. Bot.* vol. 2, p. 99 and 101.

Province of Corrientes: In a wood planted by Jesuits at Candelaria, *Bonpland* No. 596! Herb. British Museum. This is possibly only a more entire leaved state of the preceding form (*I. vestita*), but I have seen no specimens exactly like those of Bonpland, and it would seem that Bonpland considered this plant to be the same as the typical glabrous-stemmed form of *I. paraguariensis*, since there is a specimen of the latter in the Kew Herbarium labelled—"Given to Mr. Fox by M. Bon-"pland (on his return from Paraguay), under the name '*Ilex theæzans*—"*Maté du Paraguay*.'"

The *I. bonplandiana*, Münt., is evidently in every way identical with Miers' var. *idonea*, which Miers states was sent with No. 596 by Bonpland, and I have very little doubt is merely a vigorous shoot of the same plant. Münter appears to have misunderstood Miers' statement that the leaves were "obsoletely dentated."

It is not improbable that these different forms may produce different qualities of tea, as stated by Miers, but I do not think they are specifically distinct; more ample material, however, together with careful observations made in their native country, is needed to definitely settle whether these forms are really one or more species.

2. **Ilex fertilis,** *Reiss. in Fl. Bras.* vol. 11, part 1, p. 42, t. 11, f. 3 (Feb. 1861).

I. gigantea, *Bonpl. ex Miers in Ann. and Mag. Nat. Hist.* 3rd ser. vol. 8, p. 394 (Nov. 1861); and *Contrib. Bot.* vol. 2, p. 104, pl. 64; *Münt. in Mittheil. Naturwiss. Ver. Neu-Vorpomm.* vol. 14, p. 186, t. 1, f. 2, 9, 10, 11; and reprint, p. 84.

S. Brazil: *Sellow!* Kew Herb. Province of Rio Grande: Santa Cruz, *Bonpland!* and Province of Entrerios: Banks of the River Parana, *Bonpland!* British Museum Herb.

3. **Ilex humboldtiana,** *Bonpl. ex Miers in Ann. and Mag. Nat. Hist.* 3rd ser. vol. 8, p. 395; *and Contrib. Bot.* vol. 2, p. 105, pl. 65, f. A; *Münt. in Mittheil. Naturwiss. Ver. Neu-Vorpomm.* vol. 14, p. 190; and reprint, p. 88.

I. crepitans, *Bonpl. ex Miers in Ann. and Mag. Nat. Hist.* 3rd ser. vol. 8, p. 395; *and Contrib. Bot.* vol. 2, p. 105; *Münt. in Mittheil. Naturwiss. Ver. Neu-Vorpomm.* vol. 14, p. 191, t. 2, f. 5, 6; and reprint, p. 89.

I. paraguariensis *var.* angustifolia, *Reiss. in Fl. Bras.* vol. 11, part 1, p. 63, t. 13, f. 17.

Brazil: *Lobb* No. 33! *Burchell* No. 3381! Kew Herb. Province of Rio Grande: Mountains of Santa Cruz, *Bonpland!* British Museum Herb.

4. **Ilex ovalifolia,** *Bonpl. ex Miers in Ann. and Mag. Nat. Hist.* 3rd ser. vol. 8, p. 396; *Münt. in Mittheil. Naturwiss. Ver. Neu-Vorpomm.* vol. 14, p. 195; and reprint, p. 93.

I. paraguariensis *var.* acutifolia, *Mart. Syst. Mat. Med.* p. 61.

I. paraguariensis *var.* longifolia, *Reiss. in Fl. Bras.* vol. 11, part 1, p. 62, t. 13, f. 16, and t. 20.

I. brevifolia, *Münt. in Mittheil. Naturwiss. Ver. Neu-Vorpomm.* vol. 14, p. 195, t. 2, f. 1–4; and reprint, p. 93.

Brazil: *Burchell* No. 3115! *Gomes! Sellow* Nos. 383! 4633! Rio Janeiro, *Glaziou* No. 7573! Kew Herb. Province of Rio Grande:

Fraxinal, and towards Rio Pardo, *Bonpland* No. 2425! Rio Janeiro, *Richard*. British Museum Herb.

5. **Ilex nigropunctata**, *Miers in Ann. and Mag. Nat. Hist.* 3rd ser. vol. 8, p. 397; and *Contrib. Bot.* vol. 2, p. 107, t. 66; *Münt. in Mittheil. Naturwiss. Ver. Neu-Vorpomm.* vol. 14, p. 198; and reprint, p. 96.

I. paraguayensis *var.* γ, *Hook. Lond. Journ. Bot.*, 1842, vol. 1, p. 33 (p. 35 by error), t. 3.

I. affinis *var.* angustifolia, *Reiss. in Fl. Bras.* vol. 11, part 1, p. 70, t. 14, f. 9.

Brazil: *Riedel!* Botanic Gardens, Rio de Janeiro, *Miers* No. 3899! Kew and British Museum Herb.

This is the plant now in cultivation at Kew.

The two following do not belong to the genus Ilex.

**Symplocos lanceolata**, *A. DC. Prod.* vol. 8, p. 253; *Münt. in Mittheil. Naturwiss. Ver. Neu-Vorpomm.* vol. 14, p. 203; and reprint, p. 101.

Ilex amara, *Bonpl. ex Miers in Ann. and Mag. Nat. Hist.* 3rd ser. vol. 8, p. 395; and *Contrib. Bot.* vol. 2, p. 105, pl. 64, f. B; *Münt. in Mittheil. Naturwiss. Ver. Neu-Vorpomm.* vol. 14, p. 189; and reprint, p. 87.

Brazil: *Martius* No. 723! Province of Minas Geraes, *Claussen!* Mountains of Santa Curz, *Bonpland!* Serra de São José, *Glaziou*, No. 16246! Environs of Rio Janeiro and D'Ouro Preto, *Glaziou*, No. 14528! Kew Herb. A specimen from *Bonpland* also in the British Museum.

**Elæodendron quadrangulatum**, *Reiss. in Fl. Bras.* vol. 11, p. 33, t. 5, f. 1 and 2.

" Celastrus quadrangulatus, *Schrad. in Goett. Anz.* 1821, p. 716."

" Ilex acutangula, *Nees in Flora* 1821, vol. 1, p. 329; *Hook. and Arn.* in *Hook. Bot. Misc.* vol. 3, p. 171; *Münt. in Mittheil. Naturwiss. Ver. Neu-Vorpomm.* vol. 14, p. 199; and reprint, p. 97."

Ilex paraguayensis, *Hook. in Bot. Mag.* t. 3992.

I have seen no specimen of this plant, but believe the above to be its correct synonymy.

N. E. Brown.

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## CCXLVIII.—NEW ORCHIDS: DECADE 2.

11. **Pleurothallis subulata**, *Rolfe, n. sp.*—Caules graciles. Folia cordato-oblonga, apice attenuata, subobtusa, 4½ poll. longa, 1½ poll. lata. Flores solitarii. Spatha lanceolata, 6 lin. longa. Pedicellus 6–7 lin. longus. Sepalum posticum ovato-oblongum, acutum, 6 lin. longum, 4 lin. latum. Sepala lateralia omnino connata, ovato-oblonga, subacuta, postico æqualia. Petala subulata, 3 lin. longa. Labellum subpandurato-ovatum, acutum, 3 lin. longum, 1¼ lin. latum. Columna brevis.

A species belonging to Lindley's section *Macrophyllæ fasciculatæ*, which flowered in the collection of Baron Hruby, of Peckau, Bohemia, and was sent to Kew for determination through Messrs. F. Sander & Co., of St. Albans. Lindley separated the species with flowers over half an inch long from those with smaller flowers, under the name *Grandifloræ*, and into this group the present species would fall. But I believe this arrangement is purely artificial, and were it abolished, *P. subulata* would be placed near to *P. cardiothallis*, Rchb. f., which it closely resembles in several respects, though its flowers are far larger. Like several of its allies, it has flowers of a dark lurid purple. Its native country is not recorded. The name refers to the petals.

12. **Restrepia ecuadorensis**, *Rolfe, n. sp.*—Caules 3–4 poll. longi, vaginis ancipitibus vestiti, unifoliati. Flores fasciculati, pauci, heterochronici. Bracteæ oblongo-lanceolatæ. Pedicelli graciles, 2 poll. longi, apice unibracteati. Sepalum posticum basi lanceolatum, medio subulatum, apice clavatum, 1 poll. longum. Sepala lateralia omnino connata, cucullata, 10 lin. longa, 4 lin. lata. Petala sepalo postico similia, minora, 9 lin. longa. Labellum subpandurato-ligulatum, emarginatum, fimbriato-denticulatum, papilloso-muriculatum, juxta basin utrinque cirratum, 4½ lin. longum, cirri ½ lin. longi. Columna gracilis, apice clavata, 2½ lin. longa.

Closely allied to *R. antennifera*, Kunth., but differing in the shorter lateral sepals, and in various other floral details. It is said to be a native of Ecuador, and was sent to Kew for determination by Messrs. F. Sander & Co., of St. Albans. The dorsal sepal and petals are pellucid white, lined with maroon at the base, the former with a yellow tip, the latter with purple ones. The lateral sepals are very densely spotted with maroon on a pale ground, the spots becoming suffused on either side near the base. The lip is similarly spotted on a yellow ground, but near the base the spots become of a clear purple shade, and the apex is covered with small papillæ with yellow points; the basal bristles are also yellow. The pallid column has a very deep maroon blotch near its base and a deep yellow eye-like spot on either side of the insertion of the lip.

13. **Restrepia Shuttleworthii**, *Rolfe, n. sp.*—Cæspitosa, circa 3–4 poll. alta. Caules graciles, laxe vaginati, foliis æquales; vaginæ conduplicatæ, lanceolatæ, acutæ, 6–9 lin. longæ. Folia ovato-oblonga, apice tridenticulata, carnosa, 1¼ poll. longa, 6–10 lin. lata. Flores solitarii; pedicelli ½ poll. longi. Bracteæ spathaceæ, apice subacutæ, 2 lin. longæ, purpureo-maculatæ. Ovarium purpureo-punctatum. Sepalum posticum 5 lin. longum, basi subulato-lanceolatum, concavum, apice supra medium attenuatum, apice crasso-clavatum; sepala lateralia fere omnino connata, 5 lin. longa, 2½ lin. lata. Petala 4 lin. longa, angustissima, apice clavata. Labellum subpandurato-ligulatum, truncatum, læve v. obscure muriculatum, 2½ lin. longum, basi utrinque falcato-setacea. Columna clavata, 2 lin. longa, basi bituberculata.

A small, brightly-coloured Andine species, sent to Kew for determination, in March 1891, by Messrs. Charlesworth, Shuttleworth & Co., of Heaton, Bradford. It is allied to *R. xanthophthalma*, Rchb. f., but differs in shape of leaves, colour of flower, and other details. The lateral sepals are of the lightest yellow, with large crimson-purple blotches; the dorsal sepals and petals are also very light yellow, the former with a few purple spots near the base; and the lip densely covered with blackish-purple spots. The column is very pale green, with a pair of orange spots on

its swollen base. A plant from the same source flowered in the Kew collection in March of the present year.

14. **Dendrobium platycaulon,** *Rolfe, n. sp.*—Pseudobulbi valde compressi, ancipites, lanceolati, circa 3–5-foliati, 4–7 poll. longi, 1–1¼ poll. lati. Folia oblonga v. elliptico-oblonga, acuta, sessilia, 2½–3½ poll. longa, 1–1¼ poll. lata. Racemi breves, 3–6 flori. Bracteæ triangulari-ovatæ, acutæ, 1 lin. longæ. Flores straminei. Pedicelli 6–8 lin. longi. Sepalum posticum lineari-oblongum, obtusum, 7 lin. longum; sepala lateralia similia, leviter carinata, basi in mento 7 lin. longo producta. Petala sepalis paullo latiora. Labellum hastato-trilobum, late unguiculatum, lobo medio late oblongo emarginato, lobis lateralibus rotundatis, disco leviter tricarinato in medio. Columna brevissima.

A species closely resembling *D. lamellatum*, Lindl., but with the flowers twice as large, and the lip quite different in shape. The pseudobulbs are also considerably more elongated. The flowers, which measure over an inch in length, are straw-coloured. It was imported by Messrs. F. Sander & Co., of St. Albans, from the Philippine Islands, and flowered both in 1890 and during the following year. It has also been sent from the Glasnevin Botanic Garden, by Mr. F. W. Moore, having being acquired from the same source.

13. **Bulbophyllum densiflorum,** *Rolfe, n. sp.*—Rhizoma repens. Pseudobulbi ovoideo-oblongi, 1¼ poll. longi, diphylli. Folia oblongo-lanceolata, acuta, pallide viridia, circa 4 poll. longa, 10 lin. lata. Scapi suberecti, circa 5 poll. longi; racemi penduli, densiflori, 2 poll. longi. Flores parvi, lutei, fœtidi. Bracteæ elliptico-ovatæ, valde concavæ, breviter acuminatæ, glabræ, 2 lin. longæ. Sepalum posticum ovatum, obtusum, concavum, glabrum, 2 lin. longum. Sepala lateralia supra medium connata, 3 lin. longa, cæteris similia. Petala oblonga, apiculata, glabra, uninervia, 1½ lin. longa. Labellum ovato-oblongum, obtusum, carnosum, glabrum, 1½ lin. longum. Columna brevis, alis subfalcatis acutis.

A small species closely allied to *Bulbophyllum triste*, Rchb. f., but differing therefrom in its longer raceme of yellow, not deep purple, flowers, and in certain details of structure. It was sent to Kew by Mr. Nelson Campany, The Gardens, Thedden Grange, Alton, Hants, during September 1891. The sepals and petals are light greenish yellow and the lip deep yellow. The flowers have a rather fœtid smell. It is said to have been imported from the Eastern Himalayas.

16. **Eria cristata,** *Rolfe, n. sp.*—Pseudobulbi teretes, apice paullo incrassati, 3–5 poll. longi, 3–4-phylli. Folia oblongo-lanceolata, acuta, 2½–3½ poll. longa, 8–10 lin. lata. Flores gemini. Bracteæ ochraceæ, oblongo-ovatæ, obtusæ, parce pubescentes, 6 lin. longæ, 3½ lin. latæ. Pedicelli albido-pubescentes, 8 lin. longi. Sepala ovato-lanceolata, subacuta, 8–9 lin. longa; lateralia carinata. Petala lineari-lanceolata, subobtusa. Labellum 5 lin. longum, trilobum, recurvum, lobo medio obovato-rotundato tomentoso basi cristato, lobis lateralibus rotundato-oblongis obtusis, disco tomentoso obscure tricarinato, apice bicalloso, callis lævibus. Columna brevis.

A pretty little species, belonging to the section *Cylindrolobus*, which has been cultivated at Kew for several years. It was originally sent from Moulmein by Mr. C. Peché, in 1882. It is nearly allied to *E. marginata*, Rolfe, which, however, has the lip, and especially the side lobes, margined with red, and a quite different crest. *E. cristata*

has the sepals and petals pure white, and the lip yellow, somewhat darker on the disc and margins of the side lobes. The structure of the system of crests is rather complex. On the hairy disc between the side lobes are three obscure keels, which at the apex of the side lobes suddenly terminate in a pair of truncate very fleshy crests, at this point destitute of hairs; in front of these is a pair of deep cavities, one on either side, and between them an elevated plate covered with yellow hairs, thus forming a tuft or crest, in allusion to which the name is given. The column is white, with some yellow markings on the foot, and a yellow anther-case.

17. **Odontoglossum auriculatum**, *Rolfe, n. sp.*—Pseudobulbi ovoidei, compressi, 1–2 poll. longi. Folia linearia, subacuta, 6–8 poll. longa, 6–9 lin. lata. Scapi erecti, circa 8–12 poll. longi, laxiflori. Flores stellati. Sepala patentia, lanceolata, acuminata, 12–14 lin. longa, 3–4 lin. lata. Petala sepalis similia. Labellum longe unguiculatum, trilobo-hastatum, circa 15 lin. longum, lobo medio anguste triangulo acuminato, lobis lateralibus rotundatis, disco bicornuto. Columna elongata, 9 lin. longa, alis brevissimis crenulatis.

A pretty little species closely allied to *O. lindleyanum*, Rchb. f., but differing in having a hastately trilobed lip, the disc of which is light purple instead of brown. In other respects it is much like the species just named. The sepals and petals are light yellow with a large light brown blotch near the apex, and a few much smaller ones below. The long claw of the lip, the side lobes and crests are white, the disc light purple, passing into light brown towards the apex of the front lobe. It was imported by Messrs. F. Sander & Co., of St. Albans, with *O. nævium*, Rchb. f., and has been sent to Kew for determination on two or three occasions; a living plant has also been presented to the collection, and it has recently flowered. It seems quite constant in character, and different from anything which has before appeared, though at first I thought it must be an anomalous variety of *O. lindleyanum*. The name is given in allusion to the ear-like side lobes of the lip.

18. **Odontoglossum guttatum**, *Rolfe, n. sp.*—Pseudobulbi subcompressi, ovoideo-oblongi, ancipites, $1\frac{1}{4}$–$1\frac{1}{2}$ poll. longi, 1–$1\frac{1}{4}$ poll. lati. Folia lanceolato-linearia, acuta, 9–12 poll. longa, $1\frac{1}{4}$–$1\frac{1}{2}$ poll. lata. Scapus $\frac{3}{4}$ ped. altus; racemus multiflorus. Bracteæ ovato-oblongæ, acutæ, 4–5 lin. longæ. Pedicelli 9–10 longi. Sepala subpatentia, concava, lanceolata, acuminata, $1\frac{1}{3}$ poll. longa, 4 lin. lata. Petala paullo minora, subincurva. Labellum breviter unguiculatum, subhastatum, lobo medio acuminatissimo, lobis lateralibus rotundatis recurvis crenulatis, disco bicalloso, callis magnis erectis lamellatis, apice irregulariter dentatis v. truncatis. Columna clavata, alis amplis irregulariter fimbriatis.

This species was sent to Kew for determination by G. R. le Doux, Esq., of Langton House, East Molesey, in March of the present year, with the information that it is a native of Ocana, whence it was imported as *O. blandum*, Rchb. f., in 1886. It is allied to *O. odoratum*, Lindl., but differs in the shape of the column wings and crests, also in colour. In its fimbriate column wings it recalls somewhat *O. præstans*, Rchb. f. and Warscew., and *O. crocidipterum*, Rchb. f., which, however, differ greatly in other characters. The flowers are light yellow in colour, irregularly blotched with chocolate, the spots being almost suffused on the upper halves of the sepals, and elongated into three narrow lines at the base of the petals. The lip is bright yellow on the

reflexed side lobes, with a few small reddish-brown spots, the calli and disc nearly white, the front part of the lip chocolate and a few paler spots and lines on the erect sides of the unguis. The column is whitish yellow, with a few reddish-brown spots on the sides, face, and wings. The plant has since been presented to Kew.

19. **Vanilla ensifolia**, *Rolfe, n. sp.*—Scandens, caulibus elongatis sulcatis lævibus. Folia petiolata, elongato-linearia, subattenuata, acuta, 4–8 poll. longa, 6–10 lin. lata, petiolus 3–5 lin. longus. Racemi axillares, abbreviati, floribus subfasciculatis. Bracteæ lanceolato-ovatæ, acutæ, 2–3 lin. longæ. Pedicelli 1–1¼ poll. longi. Sepala lineari-lanceolata, acuta, 2 poll. longa, 3 lin. lata. Petala sepalis subsimilia, subfalcata, nervo medio paullo incrassata. Labellum elliptico-oblongum, crenulatum. Columna 1⅓ poll. longa. Fructus non visus.

**New Granada**; prov. Cauca, *Goudot*; Patia, *Herb. Pharmaceutical Society*, from Mr. T. Hanbury, 1884.

This is a very distinct species, readily distinguished from every other by its narrow, sword-like leaves. The lip of the only examinable flower is imperfect, so that it is impossible to add any details about the disc and crest. It is described from dried specimens.

20. **Spiranthes olivacea**, *Rolfe, n. sp.*—Planta circa pedem alta. Folia radicalia petiolata, lanceolato-oblonga, acuta, 1–1½ poll. longa, 5–6 lin. lata. Scapus 10–12 poll. longus, gracilis, pubescens, multiflorus. Bracteæ lanceolatæ, acutæ, 3 lin. longæ. Flores subsessiles, 3 lin. longi. Sepala lateralia linearia, subobtusa, sepalum posticum cum petalis in galeam connivens, lanceolato-lineare, obtusum. Petala spathulata, obtusa. Labellum lineari-oblongum, apice in limbum suborbicularem crenulatum expansum, basi subventricosum, medio bicallosum, callis parvis, pubescentibus. Columna lineari-clavata, 1½ lin. longa.

A small species, introduced from North Peru by Messrs. Charlesworth, Shuttleworth & Co., of Heaton, Bradford, and by them presented to Kew, where it flowered in March of the present year. It is allied to *S. Preslii*, Lindl. (*Cyclopogon ovalifolium*, Presl., *Rel. Hænk.*, i., p. 93, t. 13, fig. 1), also a Peruvian species. The leaves are of a dark glaucous- or olive-green shade, with a few very small white blotches. The sepals are light olive green below, tipped with very light pink above; the petals of a similar shade below, passing into pellucid white above, with a pink mid-nerve; and the lip also white, margined with green about the middle of the claw, which point is also a little broader and appressed to the sides of the column.

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## CCXLIX.—SISAL HEMP IN THE BAHAMAS.

The following interesting account of the fibre industry in the Bahamas has been recently communicated to Kew by his Excellency Sir Ambrose Shea, K.C.M.G., Governor of the Bahmas:—

Sir Ambrose Shea, K.C.M.G., to Royal Gardens, Kew.

Government House, Bahamas,
April 11, 1892.

Dear Sir,

I have asked the Crown Agents to order in the meantime six copies of the *Kew Bulletin* for this Government, and I have notified

parties wishing to become subscribers that I will have their orders forwarded.

I notice you give a good deal of attention to our fibre cultivation. It is really a most promising enterprise and I believe will financially realise all reasonable expectations.

It will not become what is called a boom, for the production is necessarily a gradual movement, but as far as the future of the industry can be inferred from experience and existing facts, the calculations of its progress and value may be made with an unusual degree of certainty, so stable are its general conditions.

The growth of the plant is unfailing, it being proof against drought and every known adverse influence. It matures fully in four years and then yields 10 or 12 annual crops without further cultivation. The fibre is of unsurpassed excellence, and a recent experiment shows that it takes a dye readily, and eminent fibre merchants in London have informed me that they only desire to be assured that they can depend on a supply.

Such a state of facts is full of promise for the future prosperity of the colony. The export is now beginning, and the whole for the year will be from 150 to 200 tons. This will be an increasing quantity in the succeeding years, and a careful estimate places the output at 14,000 tons in 1900. At the low price of 20*l.* a ton this would give an export of 280,000*l.*, which, added to the normal export of the colony (130,000*l.*), makes 410,000*l.* eight years hence (to which the intervening years will be a steady approach), and we thus have in view a production more than three times of any in the experience of the colony.

But there is no reason why it should rest here, and it can be predicted with as much safety as can belong to any forecasts into the future, that in ten years of the new century the industry will have reached a result of 50,000 tons, the value of which can be readily seen.

In these estimates I have taken due account of the competition which this colony has stimulated by its enterprise, and the price I have named will satisfy dealers in the article that I am under the influence of all necessary restraint in this respect. I do not think many of our imitators will be successful, for it requires special combined conditions of soil and climate to produce such a fibre as ours, and in a spirit of self defence, the legislature has extended for five years an Act now three years in existence, which prohibits the export of fibre plants from the colony. This must affect the competition which has been spoken of, for some of the places in question had been relying on supplies of plants from our growers when the first prohibitory law should have expired.

The cultivation in Florida has been proposed, but this is not seriously considered by us. The plant is inferior, wages much more than double what is paid here, and there is a well-known liability to frost, which is fatal to fibre growth. As far as the best informed judgment can at present be a guide, we have no grounds for apprehension that our position can be seriously disturbed, or that in any conceivable conditions in the future the fibre cultivation in this colony will be placed below the limits of profitable adventure. The Government have restricted for ten years the amount of Crown allotments to 100,000 acres, which embraces the maximum product of 50,000 tons I have referred to. These allotments have been widely distributed to secure for the largest possible number of the people the advantage of employment, and a disturbance of the labour market is also guarded against. One of the many attractions of this remarkable industry is in the fact that strikes are all but impossible, for they will have no plausible basis. The crop may remain

unharvested for months without injury, and the good sense of the people may be safely relied on to recognise this fact, and also to make them feel, as they now do, that men of means coming to the colony to engage in its fortunes are its best benefactors, and this is being brought home to them by the improvement in their condition arising from the operations in which capitalists have already engaged.

I am, &c.
(Signed) A. SHEA.

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## CCL.—NONNEN PEST IN BAVARIA.

(*Liparis Monacha.*)

In the *Kew Bulletin*, 1890, p. 224, an account was given of a formidable forest plague which had made its appearance in Bavaria. The pest consisted of the caterpillars of a moth known as the "nonnen" that has been known to attack forest trees on the Continent more or less for the last 200 years. In 1890 the damage done was so great that the loss to the revenue from woods and forests was estimated to amount to about 40,000*l*. In a recent despatch received by the Foreign Office from Her Majesty's Minister Resident at Munich, and communicated to Kew, a further account of the Nonne pest is given with the details of the various steps taken to mitigate the attack. So far an expenditure of nearly 100,000*l*. has been incurred in the campaign against the nonne pest by the Bavarian Forest Department.

FOREIGN OFFICE to ROYAL GARDENS, KEW.

SIR, Foreign Office, 19th March 1892.

WITH reference to the letter from this office of July 7, 1891, I am directed by the Secretary of State for Foreign Affairs to transmit to you, to be laid before the Director of the Royal Gardens, copy of a despatch respecting steps taken to combat the "nonnen" in Bavaria.

I am, &c.
The Assistant Director, (Signed) JAMES W. LOWTHER.
Kew Gardens.

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[Enclosure.]

HER MAJESTY'S MINISTER RESIDENT, MUNICH, to FOREIGN OFFICE.

MY LORD, Munich, 15th March 1892.

WITH reference to Mr. Helyar's despatch [No. 17 Commercial, of June 30th, 1891,] upon the terrible destruction of Bavarian forest trees by the "nonnen," I have the honour to inform your Lordship that in the debate on the estimates of the Bavarian Forest Department, Baron von Riedel, the Minister of Finance, made a very interesting statement in respect to the steps taken to combat the pest, and the result therefrom.

In a few words his Excellency stated as follows:—

"Previous to June 1889 the danger of so great a plague was not known. In 1888–9 several measures to destroy the 'nonnen' were taken, but none of a comprehensive character; from that time foresters had gradually learnt by experience.

"The false hope that the bare stripped fir trees would grow again did much harm, leading people to put their hands in their pockets, and sit still instead of taking active measures. Hundreds of marks, again, had been spent where thousands should have been laid out. No one had any idea of the real extent of the calamity. In 1890, 60,000 caterpillars were counted on one tree stem alone. The experience gained in the Dürrubucher Forest in Niederbayern had been of great service, and one could now combat the 'nonnen' with practical well-directed measures. With what energy they had been carried out was shown by the fact that since 1889, 79 kilometres, or 48¾ miles, of light railroad had been made in the injured forests. 1,700,000 cubic yards of wood had been cut in the Ebersberger Forest alone, and in general all the wood cut had been sold without material loss in price.

"Thousands of workmen had been employed and laborious steps taken to carry out a well conceived plan. It had been said that the lime rings were useless because the insects passed their lives in the upper parts of the trees. But it was proved that probably 70 per cent. of the caterpillars crept or fell to the ground particularly on warm days and returned in the evening. Thus by means of the lime rings, which stopped the returning insects in a mass, they were able to kill them by thousands, which proved the use of the rings. The diseases which attack the 'nonnen' were not yet sufficiently understood. The Government could not wait for an eventual deliverance from nature, but must bestir itself. In the Ebersberg Forest especially (23,000 morgen in size) [1 morgen = 1 acre] it was hoped to overcome the 'nonnen.' Communes and private persons had asked the aid of the State, but unfortunately money was wanting. Lime in abundance had been offered to the neighbours of the State forests; unfortunately some had refused, through want of belief or want of time. All ought to unite in combatting the evil. The campaign against the 'nonnen' cost 2,000,000 marks [100,000*l.*] as against 12,000,000 marks [600,000*l.*], the amount of the proceeds of the timber sales. By united exertions Bavaria might hope to drive away this great danger to her forests."

It will be observed that the Minister of Finance considers that there are hopes that the pest may at last be got rid of, but that this depends upon everyone interested carrying out the necessary remedies.

I have, &c.

(Signed) VICTOR DRUMMOND.

The Marquis of Salisbury, K.G.,
&c. &c. &c.

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## CCLI.—PRICKLY PEAR IN MEXICO.

The spread of the Prickly Pear in South Africa has led to considerable interest being taken in the best means either to destroy the plants altogether, or to render them of some service in the rural economy of the country. In the *Kew Bulletin*, 1888, p. 165, and 1890, p. 186, there is given full information on these points. In a recent despatch received by the Foreign Office from Her Majesty's Minister in Mexico, and communicated to this establishment, there is an interesting account of the Prickly Pear in what may be regarded as its native country. Even there, however, the use to which the plant is put is not important,

and it is doubtful whether on this account alone it is worth while to stay the order for its destruction which has been issued by the Government of Cape Colony. As a picture of life in the arid parts of Mexico, where hardly anything else than Prickly Pear will grow, Mr. Fletcher's account is very interesting.

### Foreign Office to Royal Gardens, Kew.

Sir, Foreign Office, June 8, 1892.

I am directed by the Marquis of Salisbury to transmit herewith a despatch from Her Majesty's Minister in Mexico, accompanied by a Report on the Prickly Pear in that country, which may have some interest for the authorities at Kew Gardens.

These papers being sent in original, I am to request that they may be returned to this Department when done with.

I am, &c.
(Signed) T. V. Lister.

W. T. Thiselton-Dyer, Esq., C.M.G., F.R.S.,
Kew Gardens.

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### Her Majesty's Legation, Mexico, to Foreign Office.

Her Majesty's Legation, Mexico,
My Lord, May 19, 1892.

I have the honour to acknowledge the receipt of your Lordship's despatch, No. 3 of February 17, 1892, enclosing copy of a letter from the Agent-General of the Cape of Good Hope, stating that he is anxious to obtain information respecting the Prickly Pear from Mexico, where in certain districts he hears that it is used as food for stock.

As my own experience is confined to the refreshing qualities of the fruit, I applied to Mr. Fletcher, manager of the Atlan Land Company, for a report, and he has sent me one which I think contains all the information required.

I also enclose an article on the subject, which originally appeared in *Longmans' Magazine*, and is copied into the *Popular Science Monthly* of New York.

I have, &c.
(Signed) Spenser St. John.

The Marquis of Salisbury, K.G., &c., &c.,
Foreign Office.

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### Mr. Fletcher to Her Majesty's Legation, Mexico.

Tulancingo, State of Hidalgo, Mexico,
Sir, May 12, 1892.

In accordance with your request I have the honour to forward to Your Excellency the following information about the Prickly Pear.

My experience is that the plant is almost invaluable in hot, dry, and specially sandy countries, where vast stretches have to be crossed by ox-teams and there is little or no water for man or beast. Some years ago I was well acquainted with that almost desert country lying

between San Antonio, Texas, and Chihuahua, Mexico; long before the advent of railroads in that part, and when nearly all the wool grown in the northern part of Mexico found its way to San Antonio, Texas, by means of large trains of ox-waggons, and I may safely say, that had it not been for that providence of nature, the prickly pear, the large traffic could not have been carried on, nor could the vast herds of sheep have been maintained in that dry arid region. It seldom rained there, and when it did the grass would spring up fresh and green, but, in a few days, the hot sun would parch it; then the winds would blow off the dried grass, leaving the ground bare again, excepting about the roots of the prickly pear where it was sheltered from the hot sun and winds and received some moisture from the roots of the plant. It appears to me that the cactus must derive its moisture and sustenance in a great measure from the air, as it thrives even on brick and stone walls in the driest climates; merely throwing out a few stray roots to prevent itself being detached by the winds or otherwise.

It is the custom when teams of ox-waggons (commonly called "prairie schooners") are travelling, to send men ahead in the afternoon to the place of camping for the night to prepare the supper for the oxen. Arriving at the destination these men set to work collecting piles of dry cactus leaves and roots with which fires are made—and here I may mention that in the absence of wood the dry plant makes excellent fuel—then the green leaves (or flattened branches to speak strictly) are chopped off the plant, stuck on forks and toasted in the flames until all the prickles are burnt off, when the leaves are cut into convenient "chunks" for the animals to masticate. This food should be allowed to cool well before it is eaten or it will sometimes produce indigestion and diarrhœa.

Cattle work and thrive on this food alone, and can go without water for several days without any apparent shrinkage in flesh or loss of muscular force. It is very curious to see the teams of oxen brace to their work and go ahead as soon as they see or smell the fire where their supper is being prepared, and when they have finished their cooked rations and are turned loose or herded, as the case may be, for the night, they will search for the ripe fruit of the plant, which is sweet, nutritive, and juicy, and abounds in great quantities nearly all the year round.

The fruit of this wild cactus is eaten by man, but is not considered wholesome, though very refreshing, yet the fruit of the cultivated varieties is quite so.

Sheep are exceedingly fond of the fruit, and when let out of the pen in the morning will race in search of the ripe fruit. Sheep will get fat in a country where there is little or nothing else but Prickly Pear; the plant needs no cooking for them, the narrowness of their mouths enabling them to gnaw at the leaves between the prickles; the leaf once opened in this manner it is an easy matter for the sheep to get at the remainder of the pulp. Sheep require little or no moisture in a Prickly Pear country.

The festive goat thrives even better than the sheep on the plant; being a climber he gets at the fruit on the upper leaves as well as the lower. There are in this country hundreds of thousands of goats maintained in the deserts on the Prickly Pear; they are killed for the sake of their skins and tallow. When the tallow is all extracted from the meat the residue is packed in bales, sent to the various markets, and sold to the poor for a cheap "meat food."

The young "leaf-shoots" or branches of the "nopal," as it is called in Mexico, are used here for various culinary purposes; they are gathered when quite young and tender, and the excrescences from which later on the prickles would develop are shaved off with a keen knife; they are then boiled in water with a certain proportion of salt until well cooked, like any other vegetable, and are then either cut into cubes to use in soup, having the flavour of the gombo of New Orleans, or sliced into narrow strips when cold, and made into a salad in the ordinary way with pepper, salt, vinegar, oil, &c., "al gusto," most refreshing and palatable, as I can assure you personally.

The sap of the leaves is used as a size to mix with lime for white-washing; the leaves are hacked with a knife, and then put into water for some time, this water being used for mixing with the lime; it is excellent for the purpose named, quite equal to the ordinary glue. I believe a vegetable glue of good colour could be made from the plant. Being a very fibrous, glutinous plant, I see no reason why it should not be a good paper-making material.

Of its medicinal qualities I know little; personally I have used it occasionally as a poultice for wounds, and to relieve rheumatism. To prepare the poultice the leaf is partially baked, or toasted in some way if an oven is not handy, then one of the outer side skins is taken off and the interior pulp minced with a knife and then applied. For a wound it can be used at an agreeable temperature, but for rheumatism it must be as hot as the patient can bear it.

All the above applies to the *wild* Prickly Pear; the cultivated species while retaining the same properties have additional merits, although cultivated in Mexico for the fruit alone.

The following are the principal varieties cultivated, viz.:—

The White Prickly Pear, the fruit of which has an agreeable acid flavour.

The yellow, rather sweeter than the former.

The crimson (Morada), large and small, quite sweet.

The "Tapona," called so by reason of its costive effect when eaten in large quantities.

The "Pelona" (naked—almost without prickles). There are two varieties of this species, producing yellow and crimson fruit respectively. Of all the Prickly Pears *this is the great forage plant*. It is almost without the objectionable prickles, and will grow in almost any climate if not very damp; the leaves are the largest and thickest, and while the average weight of the full-grown leaves of other varieties is 3 lbs., the leaves of this variety will average 8 lbs.

The Prickly Pear is generally reproduced by means of the leaves, and as it is necessary to dry them a little before planting, they will stand a long transportation.

In some parts of the country a wine is made from the fruit; here in Tulancingo a kind of sweet is made by squeezing the inside of the fruit through a cloth to extract the juice, which is then boiled in the same manner as the juice of the sugar cane.

One other species of the plant that I must mention before concluding is the "Xoconostle," the fruit of which makes a most delicious preserve. I feel sure it would "take" in England as it has that peculiar "foreign" flavour so much liked; it has a particular flavour of its own, as distinct from other jams as Indian Chutnee from the ordinary pickle of commerce.

The Prickly Pear can be easily eradicated at any time from the soil on which it grows, if it is thought better to change it for more profitable crops.

I trust that the information I have given Your Excellency may be of service.

I remain, &c.
(Signed) B. N. C. Fletcher.

Sir Spenser St. John, K.C.M.G.,
&c. &c. &c.

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## CCLII.—PALMYRA BASS FIBRE.

(*Borassus flabelliformis*, L.).

Owing to the scarcity of the Bass fibres hitherto obtained from two Brazilian palms, *Attalea funifera* (*Kew Bulletin*, 1889, p. 237) and *Leopoldinia Piassaba*, inquiry has been made in most tropical countries for palms likely to yield fibres of a similar character. A bass fibre has been obtained in Madagascar from a species of *Dypsis*; and more recently Lagos or West African bass has been obtained from *Raphia vinifera* (*Kew Bulletin*, 1891, p. 1). A fibre almost identical has still more recently been prepared in Ceylon from the Palmyra palm (*Borassus flabelliformis*). The following information has been obtained on this subject.

Director of Navy Contracts to Royal Gardens, Kew.

Admiralty, Whitehall, S.W.,
June 1, 1892.

Sir,

I shall be much obliged if you will be good enough to inform the Department whether anything is known of a material called "Bassine" said to be grown in India and dressed for the English market at Colombo, as to its value as a substitute for Brazilian Bass, and whether it is likely to displace bass on account of its quality or price.

I am, &c.
(Signed) C. M. Heath,
For Director of Navy Contracts.

The Director,
Royal Gardens, Kew.

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Royal Gardens, Kew, to Director of Navy Contracts.

Royal Gardens, Kew,
June 8, 1892.

Sir,

I am desired by Mr. Thiselton-Dyer to acknowledge the receipt of your letter of the 1st instant on the subject of fibre prepared from the Palmyra palm as a substitute for Brazilian Bass.

As shown in the enclosed extract from the Report of the Director of the Botanical Gardens, Ceylon, the fibre from the Palmyra palm is being prepared in small quantities in the north of the island. The quantity available is evidently limited, and as the palm is an important

source of food supply to the people it would be impossible to develop the industry to any very large extent without affecting that supply.

As regards the value of the fibre in European markets it may be useful to communicate to you a copy of a letter received from Messrs. Ide and Christie, a firm of fibre brokers in the City, giving particulars of the prices recently obtained for the fibre. A small quantity of the fibre as received to-day is forwarded to your address in a separate parcel.

This fibre is apparently not so good as the West African Bass (*Kew Bulletin*, 1891, p. 1), and it is decidedly inferior in length and flexibility to the Bahia Piassava (*Kew Bulletin*, 1889, p. 237). Its chief use would probably be to adulterate these fibres and not to be used alone.

I am, &c.
(Signed) D. MORRIS.

The Director of Navy Contracts,
Admiralty, Whitehall, S.W.

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EXTRACT from the REPORT of the DIRECTOR of the ROYAL BOTANIC GARDENS, CEYLON, 1891, p. 15.

*Palmyra Fibre.*—The sheathing leaf-stalks of the palmyra, as of many other palms, contains a stiff thick fibre, and a new industry in the collection of this has sprung up, under the auspices of a Colombo firm, in the north of the island. These fibres or bristles are much lke the "Piassaba" so largely exported from Brazil (the produce of the palms *Attalea funifera* and *Leopoldinia Piassaba*) for brush-making and are doubtless exported hence for the same purpose. Immense numbers of the palmyra exist in the Jaffna peninsula and the islands near, and it is in the latter especially that the business of collecting the leaf-stalks for sale has been carried on by the inhabitants. In Elavaitivu the value thus collected in six months was about Rs. 3,000, a great addition to the means of the people. Unfortunately, in their eagerness for this easy method of money-getting, they have treated the trees so badly that it is reported that in that island alone 1,000 young palmyras have been destroyed. As this palm is the principal permanent source of food in the country, and is besides of immense utility for timber, fences, &c., it became obviously necessary to put a stop to this reckless destruction, and I understand that steps have been taken to regulate the fibre industry, which, properly conducted, should become a valuable addition to the means of living for the inhabitants.

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MESSRS. IDE AND CHRISTIE to ROYAL GARDENS, KEW.

72, Mark Lane, London, E.C.,
June 7, 1892.

SIR,

WE duly received your favour of the 2nd instant and have pleasure in sending you a sample of Palmyra fibre as offered on this market. This is of average quality and valued to-day at 28*l*. per ton in London.

The first arrivals of this fibre took place about a year ago, the scarcity and high values of Brazilian Piassava having induced the production and shipment of substitutes. The early imports realized from 36*l*. to 42*l*. per ton, against West Coast African Piassava 55*l*. to 65*l*., but with

fuller supplies of these brush-making fibres (including split bamboo) market values have receded, and Palmyra ranges to day from 22*l*. to 33*l*.

The chief objection to Palmyra by manufacturers is that it lacks straightness, but experiments are being made in this country to overcome this defect, and should they prove successful it is claimed by importers and dressers that Palmyra should, for wear then, be found equal to the best Brazilian.

We are, &c.
(Signed) IDE AND CHRISTIE.

D. Morris, Esq., M.A., F.L.S.,
Royal Gardens, Kew.

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## CCLIII.—MISCELLANEOUS NOTES.

Mr. Charles H. Curtis, a sub-foreman in the Royal Gardens, has been appointed Assistant-Superintendent of the Royal Horticultural Society's Garden at Chiswick.

The principal recent acquisitions for the LIBRARY are: De Tussac's "Flore des Antilles"; Ligou's "True and Exact History of the Island of Barbados"; Tchihatcheff's "Voyage Scientifique dans l'Altai Oriental"; and Gerarde's "Catalogus Arborum fruticum ac plantarum tam indigenarum quam exoticarum in Norts Gerardi nascentum, 1596."

Mr. A. Franchet, of the Paris Herbarium, has recently presented to Kew an almost complete set of his numerous papers on the Flora of China and Japan.

The trustees of the Bentham fund have presented a considerable number of expensive books, including the principal works on FOSSIL BOTANY by Heer, Schimper, Williamson, Saporta, Gardner, Binney, Lesqereux, and others.

We have also been able to complete, or nearly so, partly by purchase and partly by exchange, various Indian and Colonial periodical publications, such as the *Journal of the Asiatic Society of Bengal; Journal and Proceedings of the Royal Society of New South Wales; Proceedings of the Linnean Society of New South Wales* and the *Proceedings of the New Zealand Institute.* And through the kindness of Sir Ferdinand von Mueller we possess a set of the *Victorian Naturalist* from the commencement.

In his recent expedition round the north coast of Madagascar the Rev. R. Baron has discovered a LABIATE WITH STINGING HAIRS. This singular plant resembles our British *Urtica dioica* and *Lamium album* in leaves and general habit. It proves to be an undescribed species of the genus *Achyrospermum.*

A valuable addition to the HERBARIUM has recently been received from Professor E. Bureau, the Director of the Paris Herbarium, Jardin des Plantes. It includes 530 species of St. Hilaire's Brazilian collections, many of them types of species first described by St. Hilaire himself. Also a small set of Guillemin's plants from the same country; a further continuation of about 200 species of Delavay's interesting Yunnan plants, and some 450 of Faurie's Japanese plants, embracing the types of new species described by Mr. A. Franchet. Finally a set of Deflers's South Arabian plants. The last contains many species not previously collected since Forskael traversed the same country about the middle of the last century.

Last year Mr. J. J. Lister, M.A., presented to Kew a collection of dried plants made by himself in the TONGA ISLANDS, and chiefly in the island called Eua, where he spent several months in 1889 and 1890, studying the geology and natural history. The collection is not a very extensive one, but it is sufficient to show that the flora is a part of that common to the Fiji, Samoa, and other neighbouring groups of islands. All the genera and most of the species are the same, and although about a score of the species appear to be undescribed it does not follow that they are endemic, because the flora of the Fiji islands is still very imperfectly known.

ADEN SENNA.—Under this name a variety of Senna appeared recently at the London drug sales. It was made the subject of a note to the *Pharmaceutical Journal* by Mr. E. M. Holmes, F.L.S. From this it would appear that the leaflets, which are hairy, have occasionally appeared in European commerce and were detected by Balka in Mecca and Alexandrian Senna. It is stated from an experiment with an infusion of two leaves that it produced a full effect upon a strong man and caused no griping, in consequence of which it seems to deserve further investigation.

From the leaflets Mr. Holmes supposes the plant to be *Cassia holosericea*, Fres., a shrubby plant of Abyssinia and Nubia extending to Arabia and as far eastward as Scinde. The Kew Museum is indebted to the Pharmaceautical Society for a sample of this Senna.

At the request of the Colonial Office the services of Kew have been enlisted to obtain for the Administration of NEW GUINEA a supply of plants of the Jamaica banana (known in Trinidad as the *Gros Michel*), and also good seed of Liberian coffee and Arabian coffee, free from leaf disease. These plants and seeds were obtained through the good offices of the Botanical Department in Jamaica. They were examined and cared for on arrival at Kew and then forwarded to New Guinea through the courtesy of the Agent-General for Queensland. As nearly all coffee-growing countries in the Eastern tropics are more or less infected with coffee-leaf disease, this supply of sound seed from Jamaica will enable the new coffee industry in New Guinea to be started under favourable conditions. It is important however to keep the plantations as free as possible from contact with seeds and plants of coffee from any other locality in the East Indies.

BAMBOO GARDEN.—The collection of hardy Bamboos and allied plants having outgrown the space allotted them in the beds near the Temperate

House, a new garden has been made for them in the wood near the Rhododendron Dell. This garden is in the form of a shallow depression with sloping banks 12 feet wide and a central pear-shaped bed 125 feet by 75 feet. To make it, the surface soil had to be removed and the gravel taken out to a depth of about 3 feet. A large quantity of new soil and manure was added so that the bamboos have now a good depth of rich soil. Two new paths leading to the Bamboo Garden have been made, one from the Syon vista and the other from the Stafford walk. The bamboos planted in the garden are :—*Arundinaria Fortunei* (Bambusa Fortunei), *A. japonica* (Bambusa Metake), *Bambusa albo-striata*, *B. gracilis*, *B. nana* (Hort), *B. palmata*, *B. plicata*, *B. pumila*, *B. tessellata*, *B. Veitchii*, *Phyllostachys bambusoides*, *P. nigra*, *P. Quilloi* (Bambusa Quilloi), *P. violescens* (Bambusa violescens, *P. viridi-glaucescens* (Bambusa viridi-glaucescens), *Thamnocalamus Falconeri* (Bambusa Falconeri) and several others unnamed. Besides bamboos it contains such plants as *Arundo*, *Eulalia*, *Crinum*, *Funkia Yucca*, etc. It is also intended to bring together in this garden a number of the coarser growing monocotyledonous plants which can be grown in the open air at Kew.

Sugar Cane Borers.

R Morgan, del. Judd & C° L^td Lith. 3880.

ROYAL GARDENS, KEW.

BULLETIN

OF

MISCELLANEOUS INFORMATION.

Nos. 67, 68.] JULY AND AUGUST. [1892.

## CCLIV.—SUGAR-CANE BORERS IN THE WEST INDIES.

During the last few years a considerable correspondence has been carried on between the Royal Gardens, Kew, and the West India Islands, respecting attacks on sugar-canes inflicted by various insects popularly described as "borers." The first of these borers, reported from St. Vincent in 1890, was the caterpillar of a moth known as *Chilo saccharalis* sometimes called *Diatræa saccharalis*. This was first described in 1828 by the Rev. Lansdown Guilding, also from St. Vincent specimens, and there is little doubt that the "moth-borer," to use the name under which it is popularly known, has been present in the West Indies and elsewhere as a pest of sugar-cane for the last hundred years. Of late it has injured sugar-cane crops in Jamaica (1841); in Mauritius (1856); in the Southern United States (1857); and in British Guiana (1879). It has been noticed also in Queensland and more recently in India. Another well-known sugar-cane borer is a weevil (*Sphenophorus sacchari*), specimens of which now in the Kew Museum No. II., were received from British Guiana through Miss Ormerod in 1880. This has been recognised as injuring sugar-canes in Barbados last year, but the exact extent of its recent depredations in the West Indies has not been clearly worked out. A third borer which has made its appearance is a minute beetle, scarcely two lines long. This has been identified as *Xyleborus perforans*, and following Miss Ormerod it has been given the name of "shot-borer." The popular name is hardly distinctive enough, as it has been "indiscriminately used to denote many beetles belonging to distinct families and of dissimilar habits." As the "shot-borer" of the sugar-cane the name may, however, have currency for the present, and no confusion need arise. This small beetle has come into prominence as a destructive pest of sugar-cane with great suddenness. Within the last two years it is credited with injuring canes in Barbados, Trinidad, and St. Vincent to a serious extent. On some estates in Trinidad it is said to have caused a loss of 30 per cent. of the sugar-cane crop, whilst in some distinct fields as much as 50 per cent. loss has been incurred. These

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injuries to a large and important industry have naturally excited considerable inquiry on the part of sugar planters, and the aid of Kew has been sought in their behalf by the local governments as well as by the Secretary of State for the Colonies, with the view of affording all possible information on the subject.

The study of Economic Entomology has not received so much attention as it deserved in this country, but Kew has been fortunate in receiving valuable aid in regard to the elucidation of problems connected with the attack of insects on cultivated plants in the Colonies from Mr. Robert McLachlan, F.R.S., Mr. Arthur E. Shipley, F.L.S., and in the present instance from Mr. Walter F. H. Blandford, F.E.S., F.Z.S., Lecturer on Entomology at the Indian Civil Engineering College, Cooper's Hill. Mr. Blandford has devoted special attention to wood-boring beetles, and a valuable paper by him on "Insect injury to barrel staves" was published in the *Kew Bulletin*, 1890, p. 181. The numerous letters and specimens received at Kew in connexion with the sugar-cane borers in the West Indies have been submitted to Mr. Blandford, and he has now prepared an exhaustive report on the subject.

This report, together with the illustrations which accompany it, will prove not only of great value in guiding any further investigations that may be carried on during the next planting season, but they will enable those practically interested to recognise the several borers and especially the "shot-borer" which is the chief subject of Mr. Blandford's present investigations and lead to a conclusion, not yet clearly made out, whether these borers attack perfectly healthy canes or are merely the followers of previous disease or injury.

## Report on Sugar-Cane Borers.

The ravages upon Sugar-cane of a small boring beetle, known as the "shot-borer," have recently attracted much attention, and aroused no little alarm among planters in the West Indian Islands. The matter is one of very great importance involving no little difficulty in ascertaining all the particulars of the insect's economy, and in basing methods of treatment on the results obtained.

The chief subject for investigation is the relation of the insect's attacks to the health and condition of the canes, whether it is a true destroyer, or merely a follower and manifestation of antecedent and more serious injury. This question I do not attempt to solve; it can only be studied in all its bearings by observers on the spot. I propose, instead, to summarise the chief facts known about the shot-borer identified as *Xyleborus perforans*, to indicate certain gaps in our knowledge of it which remain to be filled up, and to present the various opinions held on its attacks, and the evidence for and against them. The insect will be referred to in the following sections under either of the above names; it is, however, better to employ the scientific name, as the term "shot-borer" has been indiscriminately used to denote many beetles belonging to distinct families and of dissimilar habits, which agree in making shot-holes in wood.

The present account is based on the examination of all specimens and information received at the Royal Gardens, Kew, since January 1890, and on information collected by myself from other sources. I have also had access to all the documents in the India Office bearing on another phase of this insect's career.

So large an amount of literature is growing up round this insect, and so much of it is inaccessible, that it is hardly possible as yet to give an exhaustive account which shall include all recorded information.

Among the investigators who have examined these attacks and reported on them in the West Indies are Mr. Herbert H. Smith, St. Vincent (12, 13) : Mr. J. H. Hart, F.L.S., Superintendent, Botanical Gardens, Trinidad (15, 16, 17) ; Mr. J. P. d'Albuquerque, Professor of Chemistry and Agriculture, Barbados (18, 19) ; Mr. G. W. Smith, Curator of the Botanic Garden, Grenada, (20, 21), and other gentlemen.

Excellent specimens of various insects and specimens of canes have been received from Mr. J. R. Bovell, F.C.S., Superintendent of the Botanical Station at Barbados; from Mr. J. H. Hart, F.L.S., and from Mr. G. W. Smith of Grenada.

An important report (26) has just been issued by a committee of the Trinidad Field Naturalists' Club, which has made it necessary to revise and re-write much of the present account. I have found it most valuable, though I cannot agree with all the views expressed in it. This body has been referred to in my report as the Trinidad Committee, but it must not be confused with the committee appointed by the Central Board of Agriculture of that Island, which has also deliberated on this question.

In another category are the writings of Miss Ormerod (23, 24) and Mr. T. D. A. Cockerell (25), which are based, like the present paper, on reports and exported specimens, and not on personal observation of the injured fields.

Miss Ormerod has very kindly informed me that she has in preparation a pamphlet for the use of planters, &c. I have not yet had the opportunity of examining the information and advice contained in it, which would have been of great service to me in writing this account, as I know she has devoted much time and attention to the subject.

## 2. Historical.

This shot-borer has probably been known from early times to residents in the tropics, but, excluding a doubtful reference of Fabricius, it was first described in 1857 by Wollaston (2), under the name of *Tomicus perforans*. He recorded it from the wine stores of Funchal, Madeira, as feeding on the bungs of the casks, and was told that it was at times exceedingly troublesome.

He found it subsequently in the Canary Islands, burrowing in the wood of *Jatropha* (3).

About this time it attracted serious attention in British India and Burma, as a destroyer of beer-casks, and since then numerous official reports have been written on it, and much advice given, but its depredations have never been efficiently checked. The very important question, as to whether it was imported in the casks from Europe, has remained in continual dispute, owing, I believe, to the disastrous mistake of an eminent entomologist, who, in 1867, identified it wrongly with a North European species, *Xyleborus monographus*, Fabr., on the evidence of a drawing.

This mistake has had the effect of throwing the responsibility on the wrong persons, who have naturally declined to accept it, and the result has been to completely delay any settlement of the practical issues involved. The necessity of accurate study of species cannot be better exemplified than by this incident.

In 1857 Walker described it from Ceylon under the name *Bostrychus testaceus*.

In 1867 Eichhoff described *Xyleborus affinis* from Cuba, South America, &c., without identifying it with Wollaston's *Tomicus perforans;* but his very full account of both sexes enables the identification to be made with certainty when Wollaston's types are examined. This is an important fact, because a careful study of Eichhoff's exhaustive descriptions is absolutely necessary, when one undertakes systematic work on the genus (5).

Since 1867 further reports and observations have been made on the species as a cask-destroyer at the Entomological Society of London and elsewhere (4, 9), and the species attacking barrels in India was rightly identified with Wollaston's *T. perforans* from Madeira, by Mr. C. O. Waterhouse (9).

### 3. Recent Attacks.

The shot-borer came under notice as a destroyer of sugar-cane in the West Indies early in 1890, when Mr. Herbert H. Smith (12) sent it from St. Vincent, in company with the well-known cane-borer moth, *Chilo saccharalis*, Fabr.; I then identified it with Eichhoff's *Xyleborus affinis*, in which opinion Mr. Waterhouse concurred. This name, therefore, takes rank as a synonym of *X. perforans*.

Shortly afterwards Mr. Quelch, of the Museum, Georgetown, sent examples to the British Museum, as destructive to cacao trees. In answer to an inquiry, he informed me that the specimens came from Surinam, and that further information could not be obtained.

In the winter of 1891 and the spring of 1892 the attacks of the insect became so serious that numerous specimens of the beetles and of injured canes, with much information, were forwarded to the Royal Gardens, Kew, from Barbados, Trinidad, and Grenada.

I identified the specimens sent as *X. perforans*, Woll., and did the same for Canon Fowler, secretary of the Entomological Society of London from whom Miss Ormerod received the name. The responsibility for the identification is therefore mine.

Since that time there has been much attention paid to this beetle, as before mentioned, and in a year or so its economy will probably be thoroughly understood.

Specimens sent to Prof. Riley, of Washington, U.S.A., were named by him *Xyleborus pubescens*, Zimm. (26).

If this identification is correct, as is no doubt the case, this name also becomes merely a synonym of *X. perforans*. Mr. Schwarz records (10) *X. pubescens* as burrowing into a pine-tree, and though it is exceptional for a scolytid beetle to attack both conifers and deciduous trees, yet *X. Saxeseni* does so, and therefore so general a feeder as *X. perforans* may well do the same. Mr. Schwarz's description of the male of *X. pubescens* does not appear to me to tally very closely with that of *X. perforans*.

### 4. Zoological Characters.

*Xyleborus perforans* belongs to the family of *Scolytidæ*, or Bark-beetles. The *Scolytidæ* are small cylindrical weevils, distinguished from the majority of that group, the *Rhynchophora*, by possessing only a very short broad snout-like muzzle, or more commonly none at all, and with the shanks (*tibiæ*) of the legs flattened and toothed along their outer edge.

In the section *Tomicidæ* to which the *Xylebori* belong, the head is entirely covered by the hood-like prothorax, with a roughly asperate or grater-like surface sometimes confined to the front half, and the joints of the feet (*tarsi*) are linear and not flattened out into the broad fleshy pads generally possessed by weevils; the absence of these pads is, however, by no means universal among the *Scolytidæ.*

The antennæ are always geniculate, or elbowed, the first joint being elongate and set at an angle to the succeeding joints; this will serve to distinguish them from the very similar *Bostrychidæ* and *Anobiidæ*, which also bore into hard wood, and are known as "shot-borers."

## *The genus Xyleborus.*

This genus was separated in 1864 by Eichhoff from the old genus *Tomicus*, and is distinguished by the following characters:—

Head globular, hidden under a rounded or cylindrical thorax, whose anterior half is densely asperate, or grater-like, the hinder half smooth and finely punctured.

Prothorax excised ventrally up to the anterior coxæ. Tibiæ flattened, dilated towards the apex with the outer edge rounded and serrate; the tarsi can be folded up against them.

Body cylindrical, elytra punctured in rows without a depressed line along side of suture.

Males much smaller than the females, of shorter and more convex shape; they are wingless, and fertilise the females in the plant where they are bred. They are by far the rarer of the sexes, the relative numbers varying from about one in four up to one in 30 or more, according to the species.

The genus contains about 90 described species, distributed over the world: about 25 have been described from Central America and Brazil.

### Xyleborus perforans.

*Tomicus perforans*, Woll. Cat. Col. Mad. 1857, p. 96.
„ „ Col. Hesperid. 1867, p. 113.
*Bostrychus testaceus*, Walker, Ann. Nat. Hist. ser. 3, III. 1857, p. 260.
*Xyleborus affinis*, Eichh. Berl. Zeit. 1867, p. 401.
Rat. Tomicinorum, Liège, 1878, p. 372.
*Xyleborus pubescens*, Zimm. Syn. Scol. 1868, p. 145.
Schwarz, Ent. Am. II. p. 41.
? *Bostrichus ferrugineus*, Fabr. Syst. Eleuth., II. p. 388, 20.

Elongate, cylindrical, of a bright fulvous-brown, varying from pale testaceous yellow in immature specimens, sparsely covered with greyish-yellow hairs.

The *head*, invisible from above, bears two oblong black eyes, concave on their anterior edges, between which and the mouth are placed the *antennæ*, with an elongate basal joint, on which is set at an angle the five-jointed shaft, carrying an oval capitate club with a truncate hairy apex.

The *thorax* is cylindrical, half as long again as broad, slightly narrowed at base, with the anterior edge strongly rounded. In the middle of its upper surface is a rounded, somewhat transverse tubercle, in front of which the surface is rough and asperate, behind smooth, shining and finely punctured.

The *elytra* are nearly twice as long as the thorax, cylindrical with an obliquely flattened apex; shining with close rows of small punctures, the interstices between the rows having occasional scattered punctures. The first and third interstices bear at the apex of the elytra two or three small tubercles, each carrying a bristle. The second interstice is slightly depressed, and bears no tubercles.

The legs are yellow, and the *tibiæ* (shanks) have the outer edge rounded and set with saw-like teeth.

Length 1⅓ lines (2·2–2·7 mm.).

*Male* smaller and shorter, thorax with a flattened triangular cavity in front, below which the anterior margin is prolonged into a small tubercle. Wings absent; elytra only half as long again as thorax, more convex and less cylindrical than in female.

A fuller description will be found under the name *X. affinis* in Eichhoff's *Ratio Tomicinorum* (l.c.).

Several species of *Xyleborus* are only doubtfully distinct from *X. perforans*, as *X. Kraatzii*, Eich., from Ceylon, and *X. interstitialis*, Eich., from Mexico.

## 5. Geographical Distribution.

*Xyleborus perforans* appears to be generally distributed in the tropical and sub-tropical regions. It has been found in British India, Ceylon, Burma, the Malay Archipelago (I possess specimens taken by Wallace in Batchian, Dorey, Celebes, &c.), Madeira, the Canary Isles, Mauritius, Rodriguez, the West Indian Isles, North America, Central America, Brazil, Guiana, Peru, &c., and probably Australia.

To some of these localities it has probably been imported through commerce, and it is not unlikely that its original habitat is in Tropical America.

It is not certain if it occurs commonly in India away from storehouses and go-downs. These borers are but little studied, and trustworthy identifications of their species cannot well be made except by a specialist with the assistance of types.

It does not occur in Europe, but has been confounded with two European species, *X. monographus*, Fabr.; and *X. Saxeseni*, Ratz. (9).

Whether it occurs in all the West Indian islands, and how long it has been established in them, cannot be decided upon present evidence, but considering its wide distribution elsewhere, it has probably been in most of them for some considerable time.

Mr. H. H. Smith writes (12) "it is common in all parts of St. "Vincent, equally in districts where the cane disease has not "appeared."

Not having seen any record of it from Jamaica, I wrote there some time ago for any specimens of injured barrel staves, and duly found it in those sent. This fact is interesting in the face of the very ingenious *à priori* arguments advanced by the Trinidad Committee (26) to show the great improbability of the insect having been imported in barrel-staves, which they consider to be unsuited to its habits. I do not believe for one moment that it is a new-comer in the latter island, but if it is, there is evidence from all parts of the world that there is no more likely conveyance for it than a barrel-stave.

The insect's attacks have at present been recorded from St. Vincent, Barbados, Trinidad, and Tobago (meeting of the Central Agricultural Board of Trinidad, January 29th, 1892).

## 6. Food-Plants.

*X. perforans* has been found in mahogany and cacao-trees, in *Jatropha*, sugar-cane, the wood and corks of rum, beer, and wine casks, and is probably a general feeder in all dead but not dry woody matter.

Mr. J. H. Hart, of Trinidad, says (15) that it is found in quantity in old wood and furniture. This is a point of importance with regard to its attacks on casks, particularly empty ones, and these observations may be well confirmed by sending specimens taken from seasoned wood for comparison, to prevent any confusion between it and any of the very similar furniture-borers (*Anobiidæ* and *Bostrychidæ*).

The *Scolytidæ*, though attacking such hard substances as date stones and ivory-nuts, do not breed in dry seasoned wood, and if this species agrees in habit with other *Xylebori*, it can hardly do so even if it occasionally attacks dry wood as a perfect insect.

The wood of boxes sent to England containing canes full of live beetles in all stages was quite untouched, and I have not succeeded in getting them to bore into dry wood.

No remedy based on the supposition that it only feeds on sugar-cane is likely to be successful.

## 7. Life History and Habits of Scolytidæ.

The *Scolytidæ* in general differ from other beetles in the fact that the female burrows into the tree to lay her eggs (5, 7), usually turning parallel to the outside when the cambium layer is reached, and making a tunnel along the inner side of the bark at a greater or less depth. She lays her eggs in small cavities scooped out alternately on either side of this tunnel, which takes some weeks to excavate, and is sometimes forked or two-armed. The larvæ hatch and bore on their own account at first at right angles to the mother gallery. As the inmates grow their burrows widen, and generally take on an irregular course. The patterns so formed are fairly constant for the same species, and are often known as *typographs*.

The changes up to the perfect state are undergone in the bark, or sap-wood, and the imagos burrow out to the surface by separate holes.

A few genera bore deeply into solid wood: some like *Trypodendron* still lay the eggs in lateral cavities and the larvæ make separate galleries, in this case short blind tunnels deep in the wood. The newly disclosed insects pass along the mother-gallery to reach the outside of the tree.

### *The Xylebori.*

The *Xylebori* do not feed under bark but in solid wood (by exception in softer tissues like the stems of Orchids, from which I have a species), and have therefore diverged farther from the ordinary type. The females construct a system of branching galleries, in which they lay the eggs, often in a clump. The grubs do no boring on their own account, but feed in the mother-galleries on fungoid growths and sap exuding from the walls. Here they undergo their transformations, emerging by the mother-hole, so that a single hole may give exit to a whole generation of beetles, and the external appearance of the wood gives no clue to the amount of boring within. Exceptionally, as in *X. perforans*, the immature imagos bore separate holes to the surface.

Some kinds hollow out an irregular chamber without any ramifying galleries in which larvæ, pupæ, and immature insects lie in confusion. This is the case with *X. Saxeseni*, for which *X. perforans* has been mistaken (9), but which differs completely in habits.

### 8. Life History of Xyleborus Perforans.

The females are fertilised by the wingless males in the burrows where they are born, and never in the air. They fly readily, chiefly by night (26), and are among the insects most frequently attracted to lights at night (12). "The females standing on the ridge formed by the knot of the "cane enters it by a hole, at the entrance to which is usually to be found "a small heap of filings of cane fibre; this hole she makes through one "of the rootlet eyes and deposits her eggs in it from 60 to 80 in "number" (26).

According to Mr. H. H. Smith (13) the beetles enter through the holes made by the larvæ of other insects (*Chilo saccharalis*, &c.). This is a point resisted by the Trinidad Committee. Though it is not the commonest mode of entrance, I believe, from examination of canes, that it sometimes does occur, and that burrows of entrance made in this way are distinguishable from exit-holes which strike the moth burrows in their course. Burrows can be found running from the moth-holes and then forking repeatedly, which would not be the case if they had been excavated in the other direction, when they would represent the terminal branches of a forking system. There is no reason why the beetles should not avail themselves of any means of entering the cane, whose hard smooth cortex protects the greater part of the surface from attack. In casks the beetle generally takes advantage of any irregularity or grooving on the surface of the wood when beginning its burrow.

The cane is usually attacked at a node about the middle of the stem, then the joints above and below suffer, and in some cases all the joints are full of beetles.

When it has entered the female bores out a series of galleries in the neighbourhood of the node, in which the eggs are laid. I have not seen specimens which were so recently attacked as to allow of the plan of these galleries being made out.

The larvæ, as with other *Xylebori*, remain in the mother galleries, and perhaps do not bore into the cane but feed on the juices. Prof. d'Albuquerque (18) does indeed refer to their boring, and the Trinidad Committee speaks (26) of the larvæ feeding on the juice in the passages *made by themselves*, but if attention has not been called to this peculiarity in the life history of the *Xylebori*, a mistake might easily arise.

I have not found separate galleries terminated by feeding larvæ, but have seen a row of living and mature larvæ lying in a burrow with their heads towards its exit, in a position where they could not have fed on the solid tissues. The grubs are active, and may be able to turn round in the width of the burrow, for I have seen one do so in a gallery which had been laid open longitudinally.

#### *The Larva.*

The larva is a white footless maggot, about two lines long, elongate and wrinkled. The head is horny and white, the jaws being tinged with brown, the whole weakly constructed. I have not seen them feed, but have observed one open and shut the jaws rapidly. When alive it is nearly straight, the usual downward curvature of weevil grubs being little noticeable.

### *The Pupæ.*

The pupæ into which the grubs turn are also found in the galleries: they are white, about the length of the perfect insect, and of the ordinary beetle type.

"The larvæ are soon hatched, and feed for a month and a half. The perfect beetle appears after a fortnight or three weeks. The period of development from the egg to the perfect insect is about six weeks" (26)

These statements are obviously irreconcileable; allowing one week for the hatching of the egg, the period of development would seem to be about ten weeks.

When the perfect beetles emerge from the pupal skin they are almost white in colour and slowly become brown; they pass some considerable time burrowing up and down from the confused mass of galleries in the neighbourhood of the nodes, which in canes sent to England are full of rotting fungoid growth. These burrows run along the long axis of the cane between the vascular bundles, and fork at intervals, showing that more than one beetle has passed along them; the branches given off are sometimes oblique, but more often return almost immediately to the direction of the axis. Occasionally a transverse gallery runs almost round the cane just under the cortex without penetrating it; the same thing is seen in cask-staves, where burrows can be traced running in a straight line for two or three inches within a millimetre of the inner surface of the wood.

When the imagos wish to leave the cane they bore holes through the cortex, which are far more conspicuous than the entrance holes, then choked with dirt and fungus. All holes made in the internodes, except perhaps some leading from burrows of *C. saccharalis* (*v. supra*) are exit and not entrance holes. The holes made in the cane are circular, and correspond in size to the transverse section of the beetle. They are about $\frac{1}{40}$ of an inch (·6 mm.) in diameter. The internal burrows have the same width, but in cane which is not quite fresh, they will appear rather larger from the shrinking of the tissues.

Possibly the beetles sometimes lay eggs in the cane before their emergence, and thus more than one generation will be born there; and many beetles leave by the entrance-holes or the exit-holes of others, so that a piece of cane with but few exit-holes is often found riddled by burrows when cut open.

The number of broods in a year has not yet been ascertained. Those hatched when the canes are unripe are no doubt developed in cane or tree stumps, rotting canes, and moist megass; they do not breed in dried canes or megass (26).

There is not much information to hand on the time of year when the canes are attacked. They appear not to be touched till they ripen, and the worst attack is recorded to have spread most rapidly from the middle of November to the middle of December (16); when begun it goes on till the canes are cut.

The following points require further investigation:—

1. The time of year when the cane is usually attacked.
2. The connexion, if any, between the attack and the operation of trashing.
3. The character of the larval food. The capability of the larva to bore.
4. The time of development of the individual, and its duration of life.
5. The number of generations in the year, and of those passed in individual canes (if more than one).

6. Their ability to lay eggs in the cane without leaving it.
7. The ability of the beetles to attack or to breed in dry wood.
8. The per-centage of males to females.

I do not think I have seen more than eight males in the hundreds of specimens which have reached me. Their smaller size and different shape will distinguish them almost at a glance.

### 9. Natural Enemies.

These, if any, remain to be discovered. I have, however, found among specimens from St. Vincent a small beetle, *Læmophlœus*, sp., which was probably parasitic on the shot-borer. The habits of the *Xyleborus* give it great immunity from the attacks of insectivorous birds and ants, both of which have been mentioned in connexion with it (19), but a little observation should show if these are of any assistance. The *Scolytidæ* are not exempt from insect parasites (other *Coleoptera*, *Ichneumonidae*, and allied kinds).

### 10. Destruction caused by the Shot-Borer.

Putting aside the question as to whether this beetle is responsible for all the damage attributed to it, the serious nature of the outbreak will be seen by the following extracts.

#### *St. Vincent.*

Mr. Herbert H. Smith says (12), "My attention has been called to a " disease of the sugar-cane, which has lately appeared or increased on " this island . . . As yet it seems nearly confined to a few localities, " but there are indications that it is spreading. In some instances, " the managers of estates report that, at least, twenty-five per cent. of the " products will be lost.

"The canes attacked are, so far as I have noticed in one field, scattered among the sound ones, often on the same hill. They are easily recognised by their dwindling rapidly at top, and by their withered leaves; the colour is often paler than usual . . . . The cane in the worst cases is quite rotten or dried up and almost devoid of saccharine matter—in other cases it has the characteristic sour odour of acidulated cane-juice."

#### *Barbados.*

"Cane-fields which have been attacked present a dried and withered appearance and the canes seem quite rotten. In St. Vincent and Trinidad it is doing terrible damage, and in some cases as much as one third of the crop is spoilt and no one knows how it will end" (18).

#### *Trinidad.*

"The cane-fields are first affected on the outside, and the scourge rapidly extends to the whole field, affecting at least 20 per cent. of the canes" (16).

"With regard to the damage done in Trinidad we understood that one planter has sustained a loss of 30 per cent., of his crop, whilst in some distinct fields as much as 50 per cent. loss has occurred" (26).

"The canes show little or no sign on the outside until the mischief is well advanced. It shows itself in small spots like a bruise, which, when examined, reveals the fact that the cane is of a red colour right through the centre and quite sour. We have had to condemn heaps of canes for this reason. The attacks make the juice poor, and the acidity is difficult to manage.

"The disease appears seriously to affect the quality of the Muscovado sugar. Our first cargo of this season, which is just landed in Philadelphia, U.S., shows an average polarization of 85·36 against 89·4, that of our first cargo last year" (22.)

### 11. Causes which predispose the Canes to Attack.

Before considering this, by far the most important question for investigation, it will be profitable to refer to a very old controversy as to whether the *Scolytidæ* ever attack healthy plants or not.

The strongest opinions have been held about either side of this question, and much has been written upon it (7, 11).

The truth probably is that they avoid sound trees when sickly or dying ones are to be had, but do not hesitate to attack them when the supply of suitable brood-material is insufficient, and any cause has brought about an exceptional increase in their numbers. In temperate counties such an increase may be caused by an unusually hot season, which by multiplying the annual number of broods, enables them to outstrip their natural checks, or by a plentiful supply of food material in any one year arising from forest fires, damage by storms or snow, defoliation by caterpillars, drought, &c. An attack on healthy trees is usually unsuccessful at first, and the tree repels the invaders by pouring out sap into the newly made burrows, but if continued year after year the tree becomes gradually weakened and at last succumbs. In other words, they live only in unhealthy trees, and it is when they have at last succeeded in diminishing the vitality of a tree that they are able to breed in it.

Another cause that has been advanced as a possible forerunner of their attacks is the presence of a parasitic fungus, as *Agaricus melleus* (11).

As any temporary check to the health of a tree, *e.g.*, transplantation or partial loss of foliage, from which it would have recovered, may allow the beetles to establish themselves, the fact that they do not habitually attack trees in sound health does not deprive them at all of economical importance.

### *The Plum Tree Shot-Borer.*

The *Xylebori* differing from most of the family in boring deeply into the wood, instead of attacking the inner bark, are as a rule less injurious, and no European species is conspicuous as a destroyer of standing trees, except *X. dispar*, Fabr., the Plum-tree Shot-borer, which sometimes attacks young deciduous trees or branches of ½ to 2 inches in diameter. A case of this kind, where the trees were apparently healthy, has been recently recorded from Gloucestershire by Miss Ormerod (Report on Injurious Insects for 1890). Yet, in spite of these attacks on apple, pulm, and oak trees, &c., it cannot be doubted that the natural breeding place of *X. dispar* is in newly fallen trees of larger diameter, chiefly oaks and beeches.

In such the system of branching galleries reaches its normal development, whereas in young saplings it is distorted and altered, showing that these do not represent the original breeding place of the beetle.

Eichhoff, the authority on these insects, says distinctly (7) that *X. dispar* avoids sound wood for breeding purposes, if dying or newly felled timber is to be had.

There are no sufficient facts to contradict this.

Schmidberger, who first accurately recorded its habits (1), did not observe its attacking felled timber, and though Altum is quoted by Eichhoff (7) as denying the fact in his "Forstzoologie," the denial does not appear in the second edition of that work (8).

I have myself found it abundant in felled trunks in Belgium, and never in living trees.

The bad attacks on saplings, which have been observed from time to time, have begun and ended suddenly, without leaving observers in a position to point to any definite disease or peculiarity in the trees which should make them specially attractive. As the species is one of our rarest English beetles, the Gloucestershire attacks cannot be ascribed to "excessive multiplication;" possibly no proper brood material was present.

The difficulty in clearing up the economy of a well-known European and American insect like *X. dispar*, and the fact that it deserts its usual habits to become destructive, are of great assistance in considering why *X. perforans*, which has perhaps been abundant for many years throughout the West Indies, has seriously attacked the sugar-canes in a small number of adjacent islands. At the same time the analogy between *X. dispar* and *X. perforans* need not be pressed too far. The habits of these borers differ very much, and must be considered separately; those of one species form a useful guide to those of another, but it does not follow that the latter are in all respects the same.

I. *Is the attack entirely independent of the health and condition of the canes?*

II. *Does it depend upon a deterioration of their health which renders them attractive to the beetles?*

*In the latter case is the deterioration due to—*

1. *A weakly state caused by continual propagation of the same variety on the same soil, &c.:*
2. *To drought:*
3. *To fungoid disease present in the cane:*
4. *To previous attacks of other insects?*

III. *If there is a definite cause which favours the attack, is it the same in all islands where the beetle has been injurious?*

These are the questions which remain to be answered, and to be answered by investigators on the spot, for I do not believe that the examination of exported specimens will give the solution to them.

Many short pieces of cane have been sent over in alcohol, which show admirably the burrows of the *Xyleborus*, which will wrongly pass as the sole destroyer, if other insects have attacked that part of the cane which has not been presented for examination.

Canes cut in 3–4 feet lengths do indeed show other insect attacks if present, but are useless as indicating the general health of the plant, for they arrive rotten and sour, and it is impossible to determine whether that state has been set up before or after cutting.

The burrows of these shot-borers always contain more or less fungus, and when old are often black inside as if charred; therefore a plant attacked by them is certain to show evidence of fungus.

I have examined a consignment of eight or nine long canes sent from Trinidad to Kew by Messrs. C. Tennant, Sons, & Co. (22). They were full of burrows of *X. perforans*, many being fresh and containing living larvæ, pupæ, and perfect insects. The galleries occurred in all or nearly all the joints, especially at the lower part of the cane. *Every cane showed as well in one or more joints the burrows of a larger insect, of which six or seven occurred in some canes.* These were of older standing, and full of fungous growth, and as the insects which had caused them were not present, it is impossible to state positively the species.

In one or more instances the remains of a cocoon show with practical certainty that the insect was a weevil, probably *Sphenophorus sacchari* (25); from the evidence of another cocoon, *Chilo saccharalis*, the "borer-moth," was also present, and this species probably caused most of the damage. In one cane the three lower, and in another the two lower joints were hollow and rotten. This looked like the work of a large *Lamellicorn* beetle-larva, or a *Rhynchophorus* weevil. We may fairly conclude that in these particular canes the attack of *X. perforans* has followed that of other insects more especially, because one cane at least was free from the *Xylebori* altogether.

It would be possible to cut from some of these canes 1–2 foot lengths which should show no injury but the burrows of *X. perforans*.

Nevertheless, the fact that half a dozen canes have been previously attacked by other pests before *X. perforans* has touched them, though affording a strong presumption that the injury made those canes specially attractive, is no proof that the shot-borer cannot begin an attack on its own account. This can only be determined by examining a large number of canes, and counting the proportion of those attacked by *X. perforans* alone, in conjunction with other insects, and by the latter when it is not present.

Those who have studied the attacks in Trinidad, namely, Mr. J. H. Hart and the members of the Trinidad Committee, are disinclined to attribute the mischief to previous insect attacks, as is done by Mr. H. H. Smith, Mr. G. W. Smith, and others. Professor d'Albuquerque accepts *X. perforans* as the true destroyer, but as he does not discuss the question of its being a successor of other enemies, it is impossible to say from his report (18) if he has considered it.

The Trinidad Committee (26) does indeed go so far as to "believe "that the beetle is the primary cause of the disease, and that it is "immaterial to the beetle whether the cane is healthy or not," but they do not refer to the very important remarks contained in the next section. In this and in subsequent sections the opinions of various observers are given in inverted commas; the italics are mine.

### 12. Is the Attack favoured by want of Vigour in the Canes?

Mr. Hart in his report (15) says:—"Mr. Bovell and Mr. Coull also "agreed with my suggestion that the *method of propagating canes "year after year from the same stock*, the same fields, and often from "abandoned lands was liable to induce constitutional weakness."

"Canes, though possessing vegetative vigour and apparently robust health, may at the same time be what I would term constitutionally weak, and liable to attacks of blight occasioned either by the attacks of insects or fungi.

"With this view a most minute examination was made into the results of the Dodds' experiments with seedling canes, as it was expected that increased vigour would be found among the seedling varieties; my

views were fully confirmed, and there were found at Dodd's magnificent varieties of canes raised from seed, which have no sign of being attacked by the beetle-borer so destructive on St. Augustin, although in a neighbouring estate this same insect was prevalent and producing similar results as in Trinidad."

"I have noticed that the Transparent Cane and the Caledonia Queen *enjoy an entire immunity from the attack*, even when growing side by side with the badly infested Bourbon canes, and it has occurred to me that perhaps the Bourbon cane, enfeebled by long cultivation in the same land, and degenerate *from the careless way in which the propagation* (particularly in these islands) has been conducted, has now become powerless to resist the attacks of the moth [*Chilo saccharalis*], and that it would be as well to select and introduce a new variety" (20).

This last report was written by Mr. G. W. Smith, of Grenada, who believes that there the beetle follows the attacks of other insects, but it shows that there is a probability that those also depend on the canes being constitutionally weak.

Too much importance cannot be attached to these remarks, which may go to the root of the whole question, and it is greatly to be regretted that the Trinidad Committee has not dealt with it in their report.

The matter has, however, received attention at a meeting of the committee of the Central Agricultural Board in Trinidad, where in the discussion of Mr. Hart's views the objection was raised that the canes he had referred to as constitutionally weak had been most carefully raised.

Mr. Hart quite rightly pointed out that the two things were distinct. It is perfectly well known that many of the finest cultivated varieties, say, of apples or potatoes, are very liable to diseases or insect attacks, apple-canker and the like, and that this liability is not to be explained by defective cultivation.

It will assist investigations very much if planters can be induced to consider the possibility of the attack being favoured by constitutional weakness, or "receptivity" of the canes, and at the same time to recognise that an admission of the fact in no way implies want of care in cultivation, but, perhaps, if anything, the reverse.

### 13. Is the Attack due to Drought?

One member of the Trinidad Committee (26) "desires it to be placed "on record that he believes the canes, owing to abnormal conditions of "weather, are not what may be termed perfectly healthy, which fact is "borne out that the juice has this season been rather poor. The general "appearance of growth does not show this in any marked way, but "manufacture does."

"The blight being right through the West Indies points more to the canes having been affected by the unusually hot dry season last year, than to its being caused by any local surroundings" (22, extract).

This would unquestionably favour the attack, but the beetle has not begun its depredations this year for the first time, and it can hardly be the chief cause. It is noticeable that the members of the Committee are not unanimous about the sound general health of the canes.

### 14. Are the Canes suffering from Fungous disease?

This a point upon which evidence is much wanted.

Mr. J. H. Hart writes (17):—

"I find in all canes attacked by the beetle (*Xyleborus*) that the mycelium of a fungus is present (especially at the node), which per-

meated the cells of the cane in all directions, whether apparently healthy, or having unhealthy and sour contents.

"As this parasite develops, it tinges the cells of the cane with a faint red tinge, which gradually deepens in colour to a bright red as time goes on. This action has formerly been attributed to the action of the insects but the same colour and the same mycelium has been found by me in a cane untouched by either the 'Old cane borer' (*Diatræa saccharalis*), or by the new borer or beetle (*Xyleborus perforans*, Woll). I found the wood of mahogany and other woods attacked by the Xyleborus was also permeated by the mycelium of a fungus. This points to the conclusion that the destruction of the canes is first begun by the fungus, and when sourness [or an acid condition] arises is followed by the attacks of its insect enemies.

"Personally, I do not wish this view to be received as fact until it has been confirmed by others. . . .

"I learn from Prof. d'Albuquerque that he has also noted a fungus to be present, and that he was glad to have his attention directed to the subject of its investigation."

This is so important that it will be well to throw further light on the subject, by having canes examined by an expert in phyto-pathology, who will give instructions for the proper preservation of specimens, if it is necessary to send them out of the island.

As mentioned before, the burrows of *Xylebori* are habitually lined with a mycelium on which the larvæ partly feed; this is not necessarily a forerunner of the insect, and care must be taken to see that no confusion arises as to the sequence in time of the insect and fungus. *The possibility of fungous disease of the roots being present should also be considered.*

The following paragraph shows that the question of fungous disease is worthy of far more attention than it has received:—

"Dr. Benecke, the Director of the Experimental Station at Klaten, Java, has offered a prize of 1,000 marks for the best essay, founded on original observations and experiments in cultivation, on the causes of the red colour in the fibro-vascular bundles of *Sorghum*, which accompanies the disease known as 'Sereh.' A very similar disease has recently become very destructive to the sugar-cane crop in Java."—*Nature*, June 30, 1892.

The Trinidad Committee has not adopted Mr. Hart's view; the report says (26):—

"Mr. Hart has propounded a theory that the cause of the *Xyleborus* attack is the attraction offered by a microscopic fungus beginning at the knot, which permeates the cells of the cane in all directions irrespective of whether it is healthy or unhealthy, or has sour contents. It is quite possible that such a fungus—the committee has not yet found it—would cause the cane to sour, when it would assume this red tinge, but the committee differs from Mr. Hart when he says that this tinge has formerly been attributed to the insect, but that it is not the case . . . The committee has seen hundreds of cane stools with the red tinge which had not been attacked by the borers who had attacked the stools in the immediate vicinity which had not got the red tinge. Mr. Liddelow, a well known planter, in answer to some questions put to him, assured the President of this club that he had many canes with a red tinge which in his opinion was owing to the sun."

This report speaks of Mr. Hart's theory as if it were a mere speculation on his part. At all events, he says definitely that he has found a fungus present.

The acidity of the canes, a marked feature in the attack, the committee believes to be "produced (1) by the borers' interference with "the circulation of the sap, and (2) by the fermentation of the excre-"mentitious and other deposits in the burrows." But why not the fermentation of the cane juice itself? This souring, which must be set up by vegetable organisms of some kind, as yeast or bacteria, is no doubt greatly increased by the presence of the beetles; but there is good ground for supposing that they are attracted by that sour smell of fermentation which is often very marked in the wood of beer casks, and in the bark of the dying trees which they frequent, or possibly by the smell which precedes the actual souring, accompanies the early stages of fermentation."

Mr. G. W. Smith writes (20), "I have also observed that if you are careful to select specimens of withered and shrunken canes, from which the moth has not over long emerged, you will sometimes, but very seldom, find a beetle in them, but if they remain some time after *and have acquired a sour smell* (which very often can even be perceived by human observers) *you will always find on cutting open such a cane that it is full of the beetles.*"

Also in a subsequent letter he says (21), "Mr. Bovell writes me that he has noticed *X. perforans* in sour cane which showed no traces of the moth borer, and also that he has observed *diseased canes without a trace of either moth or beetle,* and I have noticed the latter (but not the former) in a few instances, but they are not at all common."

## 15. Is the presence of the Shot-Borer dependent on previous Attacks of other Insects?

This view has been held by several observers, and is supported by important evidence, but is rejected by the Trinidad Committee (26), at least as far as that island is concerned.

St. Vincent (1890); Mr. H. H. Smith reports (12), "The specimens "examined by me have been attacked by two insects, one or both of "which are certainly the direct cause of the disease." [One proved to be *Chilo saccharalis*, the other *Xyleborus perforans.*]

In a second report (13), he says, after describing the attacks of *C. saccharalis*:—

"Finally, if the cane is pretty well grown, the action of the air that has entered sours it; it then becomes attractive to several kinds of small beetles, but especially to a little brown cylindrical species of the family *Scolytidæ*; they often burrow through the acidified cane in immense numbers, and are commonly supposed to be the cause of the disease. I myself thought so, when the first specimens of cane were sent to me for examination; these were very bad cases and full of the beetles, which I naturally supposed to be the prime cause of the trouble. I now know that they are simply a result of it; *they never get into the sound canes, and often are not found in the diseased ones:* only in very bad cases where the cane has become acidified the beetles enter through the holes made by the moth larvæ for their exit.

"As the cane is already spoiled, or essentially so, the work of the beetle counts for nothing in the final loss."

The statement that the beetles enter through the moth-holes, though true to some extent, does not describe the usual mode of entrance at the nodes.

Mr. Herbert H. Smith is an experienced naturalist who was in St. Vincent for purposes of entomological research, and great weight attaches to his opinion.

From Grenada Mr. G. W. Smith reports (20)—

"1st. There is an old and well-known pest (*Diatræa saccharalis*) found in the diseased fields along with the beetle.

"2nd. Out of over 100 examples I have taken from a diseased field I have never found the beetle in canes that had not been previously attacked by the larger 'borer,' . . . , but on the contrary, I found numberless instances of canes, where the devastation done by the 'borer' (larva of the moth) was present, in which canes there is not a trace of the beetle. These examples I am not satisfied with, and shall continue to collect until I have about 400 good canes, when I should say the evidence would be conclusive, viz., that the beetle is one of the 'sequelæ' to the ravages of the moth 'borer' and not the real destroyer of the cane.

* * * * *

"I have secured about 30 specimens [of canes containing moth larvæ]; it is remarkable that in all these 30 specimens where the larvæ of the moth is actually at work, there is no sign of the beetle (except in one specimen two small holes, and there the moth is in the pupa stage), and the cane is withered and presents the same appearance as it does at Trinidad and elsewhere. I may be wrong, but I think this is how it occurs:—When the cane is younger, the larva of the moth commences its work. At first the cane shows no sign of attack, and planters who are not very close observers of such matters notice nothing; but as soon as the cane shows signs of withering and shrinking they first notice it, that is, when the moth has either already emerged or is just about to do so. Canes of the former type are then taken, cut open, and in very many cases found to contain the beetle, which is set down as the cause of the canes' decay.

* * * * *

"Owing to the ravages of the moth-borer, the *juice of the cane has become sour, and acquires a distinct smell*. The beetles are then drawn to it (to feed on their natural food), and hence their presence in such numbers in diseased canes. I have also taken a specimen of sound cane in which there was no trace of either moth or beetle, pounded it so as to rupture all the tissues, and flung it aside, *away from any cane-field;* after some time these same beetles are found in it, hence I conclude, it is, in a sour state, their natural food."

The latter remarks point to megass being very attractive while it is fresh; this has been observed by the Trinidad Committee (26).

Mr. G. W. Smith writes later (21):—

"I have further to report that a few days ago I received eight sugar-canes from Barbados. On examining them I found the small beetle, *X. perforans*, to be the same as that attacking canes in this island, but in addition I found in three of them the tracks of a much larger beetle that makes for itself a kind of nest or cocoon from the cane refuse as it eats its way through.

"I was able to secure three nests, and in two of them I found the perfect insect, which I send in a bottle of alcohol, together with the nest in which it was found; also a piece of sugar-cane showing the track made by it; this closely resembles that of the moth-borer, but I have not yet found this beetle in Grenada."

This insect sent was the weevil *Sphenophorus sacchari*, Guild., which was partly responsible for the larger burrows in the canes I have

examined from Trinidad. Mr. T. D. A. Cockerell has also found a specimen of it in Barbados cane; and writes (25) :—

"Thus it appears that the sugar-cane pest now causing injury in Barbados is not the *Xyleborus*, and not even the *Diatræa*, but the *Sphenophorus*, or weevil. This is, of course, so far as one can tell from the specimens received; but it is likely enough that the borer-moth also occurs in Barbados, and is reponsible for a part of the damage. It is clear, however, that the *Xyleborus* follows the depredations of the weevil as well as those of the moth."

This statement, though very likely true, is perhaps rather positive, considering the small amount of material he appears to have examined. My specimens from Trinidad showed previous signs of the *Sphenophorus*, but in the face of other evidence from the island I cannot possibly say on the testimony of eight canes, that that insect is the necessary forerunner of the shot-borer.

The evidence in favour of the *Xyleborus* following other insects is thus very strong, but the Trinidad Committee says (26) " Mr. Smith of Grenada has advanced the theory that the *Xyleborus pubescens* [=*perforans*] attacks the canes already subjected to the ravages of the large borer *Diatræa saccharalis*, and Mr. Cockerell of Jamaica is of opinion that it invades canes infested by the species of *Curculionidæ* (meaning it is supposed the *Sphenophorus*)."

" From these opinions, however, the Committee are compelled, by the results of their observations, to differ, at any rate so far as Trinidad is concerned. In the course of their researches the committee have found canes *which had been attacked by the large and small borers simultaneously*. In some cases the attack was made exclusively by the large borer, in others, and far more frequently, the small borer was the offender and the large borer was not present in any form. The committee is of opinion that the borers act independently of each other and that one does not follow the other. The burrows of the large borer are much too large for the purposes of the small one. In certain cases the burrows of the small borer may seem to branch from those of the larger one, but the small borer did not enter the cane by the large borer's hole, and the reason is that the small borer in the course of his travelling operations broke into the excavations of the larger insect. The committee is glad in this particular theory to have the support of Mr. J. H. Hart of the Botanic Gardens, who also condemns the idea of the small borer attacking the canes which have been entered by the large borer. Messrs. Cockerell's and Smith's theory, however, would be quite consistent with the habits of the *Xyleborus*, as they are usually understood, but then in Trinidad we have to reckon with the complete change of habits of these insects. Even supposing that the *Xyleborus* retains some of its former instincts it would not even in that case make use of the large borer's hole to effect an entrance into the cane."

These remarks call for comment. Firstly, the Committee speaks of canes " which had been attacked by the large and small borers simultaneously." This may, of course, be merely a piece of loose writing, but if the word " simultaneously " is to be taken literally as meaning " at the same period of time," it is opposed to the evidence of other observers and of the canes from Trinidad I have myself examined, in which the attack of the *Xyleborus* was begun decidedly later than that of the moth-borer or *Sphenophorus*.

Again, the theory that the shot-borer is attracted to canes damaged by other borers is not in the least dependent on the fact of its entering their old holes, which fact was never stated by Messrs. G. W. Smith

and Cockerell, to the best of my belief, but by Mr. H. H. Smith (13), and to which I have previously referred. The theory is that it is attracted by the sour smell caused by fermentation resulting on the injuries of other borers, and the Committee themselves say (26) about the *Sphenophorus* "it exhausts the saccharine fluid in the joints in "which it has lodged, filling the excavation it has made with an "excrementitious deposit injurious to the juice, *causing acidity, and* "*deteriorating it rapidly.*"

They refer to a complete change of habit, and imply that it has in Trinidad alone given up customs usual elsewhere. For what reason?

It is very greatly to be regretted that almost all who have studied this question have not taken a sufficiently broad view, but have imagined that the cause of the insect's increase must be nailed down to some one particular circumstance to the exclusion of everything else. The reasons for the multiplication of destructive insects are generally complex. Every species finds itself surrounded by a multitude of circumstances which tend to diminish its increase (*natural checks*), and others which tend to favour it. A failure of these checks alone will cause excessive multiplication, as is sometimes seen in the case of an imported species. Its enemies are not imported with it, and the insect flourishes in a strange land where it is secure from the attacks of parasites, &c. which formerly preyed on it. So, too, an abundance of suitable food, an unusually hot season, &c., may cause undue increase, and all favourable causes may operate together, when the result will be far more serious. Of course in one locality its multiplication may depend on a circumstance which is of little weight elsewhere, but it is safe to assume that whatever cause favours an insect's increase in one place will favour it in another, if it be in operation. Change of habit very rarely means change of the natural instincts of an insect, simply that its environment has been modified and that those instincts have caused it to strike out along the new line open to it. And I cannot agree with the theory of the Trinidad Committee that the insect has developed a taste for sweets in that island, which it does not possess elsewhere.

It is quite permissible to suppose that in Trinidad the insect has extended its attacks to canes which it usually leaves untouched, owing to their possessing a great variety of attractions, or to its excessive multiplication, without disregarding what has elsewhere proved attractive. It is not found that when a species like *Xyleborus dispar* turns to unrighteous courses, and injures growing trees, that it gives up its old habits; on the contrary, the system of establishing "tree-traps" to catch it depends on the fact of its being ready to resume them under favourable circumstances. These "tree-traps" consist of freshly felled trees, or cut logs which the beetles enter by preference for the purpose of egg laying, and which are removed and destroyed with their inmates.

The predisposing causes to which I have referred are in no way mutually exclusive, and the most that can be said is that in Trinidad the exceeding numbers of the insect, or the exceeding weakness of constitution, &c. of the sugar-cane, have reduced what is an important attraction elsewhere to a secondary and unimportant position.

I do not doubt that the observations of the committee are accurate, but the question as to the influence of previous borers can be easily tested, as follows.

Choose a field which is attacked both by the larger borers and the *Xyleborus*, and reckon the canes without selection till a large number, several hundred, have been examined; the more the better.

Divide them into those attacked by the larger borers (A) and those free from them (B). Count the number in each lot attacked by the *Xyleborus*, and estimate the per-centage.

If the *Xyleborus* attacks are in no way dependent on the presence of the large borers, the per-centage of canes infected by it in A will be the same as of those in B. If, on the other hand, there is a larger proportion of infested canes in A, it is manifest that either—

1. The *Xyleborus* follows the larger borers, because they have made the cane suitable for it.
2. The canes in A are suffering from some peculiarity which renders them specially attractive to *both* the large and the small borers.

So that in neither case if the per-centage is greater in A can it be said that the attack of the *Xyleborus* is independent of the health or condition of the canes.

The Committee, strengthened by the opinion of Prof. Riley (26), attribute the increase of the *Xyleborus* in Trinidad to the neglect to burn megass and refuse. This would, of course, favour the insects, but will not explain the outbreak completely, unless it can be shown that the increase has coincided with the period when the destruction of refuse was given up, and that in countries, as Guiana and Jamaica, where the insect occurs without attracting notice as a cane-pest, the megass is so treated that it cannot breed therein. Mere multiplication of the numbers of a Scolytid beetle need not involve injury to healthy plants if there are sickly ones to attack; but if due to increase in the amount of brood material caused by exceptional circumstances in any one period, it may bring about an attack, or an attempted attack, in following years, *when the supply of food has fallen to the normal amount.* In these islands there is plenty of suitable brood material, and it is remarkable that canes attacked by the larger borers should ever be free from the *Xyleborus* if its destructive habits are simply due to "overcrowding." If it has been a native of the islands for a considerable time, and has lived on a variety of other plants beside sugar-cane, clear evidence is required of very material alteration in the state of the cane-fields in the last few years before this can be accepted as the sole cause of its increase, and, therefore, of its destructiveness. For if its increase be due to this alone, it does not explain the point which the Trinidad Committee urges: that it has not merely extended its attacks to a certain proportion of sound canes, because all the unsound ones were used up, but has actually given up what is attractive elsewhere, namely, canes injured by other borers. Fortunately, it will not be difficult to check increase arising from such a cause as the neglect to burn megass.

Amongst the insect attacks on sugar-cane, there is one which is likely to be overlooked except by careful observers, that of a mite which has been found to attack the cane in Barbados and Queensland.

Mr. A. D. Michael has written an account of this animal, which is an Acarus and not a true insect (14).

## 16. Conclusions.

It will be seen that the exact character of the causes which favour the *Xyleborus* has not been fully determined, but requires further investigations, and it will be well if such are made, not with the idea that any one circumstance is solely responsible for its attacks, or to

support the observer's preconceived theories, but that all possible circumstances may be fully considered and examined in order to apportion to each its due value.

Granted that the canes must be under the normal standard of health to be attractive, it is probably a matter of indifference to the insect whether they have deteriorated through fungous diseases, the presence of an insect or another, &c. so long as they are in the desired state.

The importance of the insect is not lessened by the facts of its wide distribution and varied habits, which I have been able to record. Every entomologist knows that of two species of insect which are hardly distinguishable to the naked eye, one will be rare and barely able to maintain its succession from year to year, whereas the other will occur everywhere and flourish under the most diverse conditions. It is to the latter group that the really injurious insects belong, and among them is *Xyleborus perforans*, the destroyer of barrels in India, Jamaica, Madeira, and probably Australia, of trees in South America, and of sugar-cane in the West Indies. Its record of destruction makes it far more formidable than if it had never occurred away from the cane-fields, and it is earnestly to be hoped that no efforts will be spared to make that thorough inquiry into the causes of this outbreak in the West Indian Islands upon which alone measures of treatment can be properly based.

One other point must be touched upon. It has been often noticed that the attacks of an injurious species gradually increase to a maximum, and then cease for a considerable time. This is especially the case with defoliating caterpillars, through causes which need not be now discussed. It may be the case with this beetle; and if so, its decrease may be wrongly ascribed to remedies which have not really checked it. In view of the possibility of attacks at a later period this must be kept in mind should necessity arise.

It is usual to conclude a discussion of this kind with an expression of opinion. The impression left upon my mind by the whole of the evidence I have examined, to some of which I have not found it necessary to refer, is that:

1. *The attacks of Xyleborus perforans are not independent of the health or condition of the canes.*
2. *No one single cause will account for them in the different islands.*
3. *A constitutional weakness of the canes is a favouring circumstance.*
4. *Previous attacks of other borers are another, which may, however, depend on 3.*
5. *In Trinidad excessive multiplication may possibly have had something to do with it, but this multiplication must follow antecedent favourable circumstances.*
6. *The effects of fungoid disease and of drought upon the attacks require more consideration before they can be accepted as furthering them. There is, however, no reason why these causes, if present, should not operate.*
7. *There is reason to suppose that the beetles are attracted to any cane which has soured.*

I am prepared to change or modify any of these opinions upon further evidence, and I do not think that the time has come to assign to each possible circumstance its relative weight as a factor in producing the attack.

## 17. Economical Treatment.

If one cannot as yet dogmatise about the causes which have led to this outbreak, still less can one suggest measures which of necessity depend on a proper understanding of those causes, and, as a rule, on an intimate acquaintance with cane-growing.

When once its origin is thoroughly understood there are plenty of persons in the West Indies quite competent to apply remedies of their own devising without outside assistance; it will therefore be sufficient to suggest what class of remedies should and should not be looked to as being of service.

The economic treatment of an insect pest is of two kinds, *preventive* and *remedial*.

*Preventive treatment* is that designed to check the future spread of the insect to a wider area, or to stop attack on growing plants as yet untouched, even at the expense of those already infested, as for example, the cutting out and burning of attacked canes.

*Remedial treatment* aims at saving a plant by killing the insects on it, as when trees are sprayed to destroy blight or scale.

No *remedial measures* in this sense are possible for canes injured by the shot-borer; when attacked by it they are lost, and though they may be perhaps made useful if cut out and crushed at once, there is no way of saving them as growing canes.

The former is therefore the only treatment to be discussed.

## 18. Increase of the Constitutional Vigour of the Canes.

This may probably be the most important practical measure, if it be true that the Bourbon canes are constitutionally weak.

Mr. G. W. Smith has pointed out (20) the immunity of the Transparent, Ribbon, and Caledonia Queen canes, and Mr. Hart that of seedling canes (15).

The latter recommends securing constitutional strength by the selection of a suitable variety raised from seed [or otherwise]. The objections advanced to this, that seedling canes do not yield a sufficient per-centage of sugar, must be left to experts to compare with the loss occasioned by the borers.

## 19. Measures of Cultivation.

The unanimous opinion is that the cultivation of the attacked canes, at least on many estates, as the *St. Augustin* estate in Trinidad, is thoroughly good and cannot be improved.

Manure has been recommended by one cultivator against the attack (26), but is not likely to produce a good result. Chemical manure (kainite or nitrate of potash) has been applied to canes in Queensland to kill underground grubs (25), on which it acts as a direct poison and not by its manurial value.

It would be no good against the borer, and the idea that manuring was useful might lead to excessive employment of it. It has been shown in the case of cereals that over-manuring with nitrogenous fertilisers results in rank growth, and a weak stalk which is readily beaten down by wind; now the Bourbon canes have a thinner rind than the

varieties not attacked, and anything which pushed them to excessive growth might make them more susceptible by increasing this peculiarity.

Perhaps this may explain why on some of the best managed estates the attack has been worst, because excessive vegetative vigour sometimes tends to "constitutional weakness."

### 20. The Destruction of other Cane Pests.

This is an obvious necessity if the attack of the shot-borer depends on their presence. The treatment of *Chilo saccharalis*, the sugar-cane moth, has been so often discussed that it is not necessary to go into it. The most recent account is that of Mr. T. D. A. Cockerell (25), published with a bibliography in the *Bulletin* of the Botanical Department of Jamaica.

The treatment of the weevil, *Sphenophorus sacchari* is less clearly known; a useful account of this and other cane pests was given by Miss Ormerod at the Entomological Society of London (6), and has been reprinted in the "Barbados Agricultural Gazette" for March 1892.

### 21. The Destruction of Brood Material.

Measures for this have been most generally recommended and adopted.

They consist in—

1. Burning trashings, megass, rotting and diseased canes and all other refuse.

With regard to the two former, I have no evidence yet that the beetle breeds in trashings, that is, in the cut-off leaves. It does occupy megass in abundance but only just when it is moist, that is, when it will not burn. Dry megass and canes which would be naturally burned it does not breed in; but they might be useful to make the others burn.

Whether trashings, megass, and any other refuse are gathered and burned must depend on whether they contain breeding beetles or are fit for their reception; because the adoption of useless measures, the destruction of material which will not again serve as a breeding place, is a waste of money.

Professor Riley, of the U.S. Department of Agriculture, writes to the Trinidad Committee (26): "I think you are perfectly correct in tracing "the increase of the *Xyleborus* to the discontinuance of the burning of the bagasse (as we call it in this country), and it seems probable "that the resumption of this custom will greatly decrease the number "of these beetles. I can hardly conceive it as possible that the insect "will oviposit by preference in healthy cane when it has a supply of "dead or dying vegetation at hand."

The Committee themselves say that dry megass contains no shot-borers, which I have myself observed to be the case; and it will be worth while examining megass to see if it really remains moist long enough to breed beetles for more than a short time after cutting. It will also be well to consider whether in countries like Jamaica and the sugar-growing districts of South America where the beetle exists without attacking the canes, the megass is treated in such a way as not to harbour them.

2. Cutting out and destroying canes diseased, or attacked by the *Xyleborus* or the larger borers.

If these can be utilised by passing through the mill so much the better. They should not be cut out and left till the beetles can complete a generation in them, or this treatment will be of little use.

3. Cutting the canes close so as to avoid stumps in which the insects will propagate.

4. Inspecting the surroundings of the fields to examine dead trees, branches or stumps for this insect, and destroying those, if any, containing them; for it is little use taking elaborate precautions to destroy rubbish, &c. in the fields if the beetles occur outside them and can fly in freely.

The measures referred to in this section are, notwithstanding possible objections to some of them, deserving of the most thorough trial.

## 22. The Protection of Standing Canes.

Miss Ormerod has recommended (19, 24) the application of kerosene and soft soap or carbolic acid to the outside of the standing canes.

Prof. d'Albuquerque writes (19): "In fields adjacent to such infested "fields in June and July, while the canes are still young, walk with a "pailful of emulsion of soft soap and kerosene recommended by Miss "Ormerod and a brush, and shake in passing a brushful over each "cane. Or to use instead the mixture of carbolic acid and water "recommended by the same authority."

I am sorry to have to dissent altogether from this advice, but I cannot conceive how the beetles, which attack the canes when they ripen, are to be kept off by wetting the plants in June and July with volatile insecticides, the effects of which would pass off perhaps in 24 hours, at most in a few days after application. Kerosene and carbolic acid are excellent remedies for destroying insects actually present or keeping off an attack which is taking place at the moment of use; but it is questionable whether the planters will care for the trouble and expense of daubing the canes from July to March with a bi-weekly coating of kerosene.

If applications of any sort are to be made to the canes to keep off the *Xyleborus*, a proceeding quite unsuited, in my opinion, on the ground of safety, economy, or effectiveness, they must be far more permanent than those recommended.

The non-volatile poisons, usually mineral salts, are too dangerous to be used (I have seen a reference to copper sulphate, of all things!), and I cannot at present suggest anything except perhaps thick muddy or clayey water which would serve as a mechanical protection to the part of the cane usually attacked.

At the same time it must be admitted that unlikely remedies sometimes achieve unexpected success, and if they do not, may lead to something more practical.

But far more important than the application of new remedies is it that the causes of these attacks shall be further investigated by thorough and painstaking researches.

However destructive *Xyleborus perforans* may be, if its destructiveness depends on some favouring circumstance, that must be sought out, and it, rather than the beetles, must be combated and overcome.

London, July 1892. Walter F. H. Blandford.

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13. 1890. . . . . . . . . . Letter to *The Sentinel*, St. Vincent, February 14.

14. 1890. *Kew Bulletin*. April, pp. 85–88.

15. 1892. J. H. HART, F.L.S., Superintendent Botanical Department, Trinidad, to Royal Gardens, Kew. January 8.

16. 1892. . . . . . . . . Report to Central Agricultural Board, Trinidad. January 29th.

17. 1892. . . . . . . . . . . to a local newspaper, dated Trinidad, May 21st.

18. 1892. J. P. D'ALBUQUERQUE, Professor of Chemistry and Agriculture, Barbados. Report to the Committee of the Barbados Agricultural Society, dated 26th January 1892. (Reprinted in *Sugar-Cane*, April 1, pp. 212–214.)

19. 1892. . . . . . . . . . . letter printed in St. Vincent *Sentinel*, April 29th.

20. 1892. G. W. SMITH, Curator of the Botanical Station, Grenada, to Royal Gardens, Kew, March 10th.

21. 1892. . . . . . . to Royal Gardens, Kew. March 31st.

22. 1892. MESSRS. C. TENNANT, SONS, & Co., to Royal Gardens, Kew. May 2. (With extract in letter from Trinidad.)

23. 1892. MISS E. A. ORMEROD. Proceedings of Royal Agricultural Society, p. 32.

24. 1892. . . . . . . . Letters reprinted in Barbados *Agricultural Gazette*, March, pp. 297–304.

25. 1892. T. D. A. COCKERELL, *Bulletin* of the Botanical Department, Jamaica, April, pp. 2–7.

26. 1892. Draft Report of the Trinidad Field Naturalists' Club Committee upon the Small Sugar-Cane Borer. *Journal* of the Club, Vol. 1, No. 2, pp. 45–50. June, 1892.

*Note.*—Several of the above reports and letters have been reprinted in various West Indian journals. There is a short account of the shot-borer in "Insect Life" for June 1892, and a further and more detailed one is promised. The insect is there named *Xyleborus piceus*, Zimm.; but this is probably a slip for *pubescens*, Zimm. (vide § 3). The only *Xyleborus piceus* was described by Motschulsky from Ceylon.

## EXPLANATION OF PLATE.

A. Sugar-Cane Moth-borer (*Chilo saccharalis*, Fabr.) after Howard.
   1. Male, upper side.
   2. Female, upper side.
   3. Larva.
   4. Pupa.

B. Weevil Cane-borer (*Sphenophorus sacchari*, Guild.).

C. Sugar-Cane Shot-borer (*Xyleborus perforans*, Woll.).
   1. Male, upper side.
   2. Female, upper side.
   3. Female in profile.
   4. Anterior leg of female.
   5. Antenna of female showing elongate basal joint (*scape*) bearing a 5-jointed shaft (*funiculus*) terminated by a somewhat hemispherical club whose flattened face indicates by concentric rings of hair the cup-shaped joints of which it is composed.

## CCLV.—PARAGUAY INDIGO.

(*Eupatorium læve*, D.C.; E. tinctorium, *Pohl MSS.*)

In 1881 the Foreign Office communicated to Kew an extract from a Despatch from Mr. Edwin H. Egerton, C.B., Her Majesty's Chargé d'Affaires at Buenos Ayres respecting certain vegetable products of Paraguay. Amongst these was a dye plant, of which Mr. Egerton gave the following account :—

"Of dyes, the dye from the *Eupatorium tinctorium*, a shrub from the leaves of which is produced a blue, long used by the Indians, and very similar to, though perhaps a little darker than, indigo, but otherwise extremely good. A small sample of it lately sent to France brought 12 francs when the Indian indigo was sold for 15 francs.

"The Central American blue dyes have generally been beaten from the field by the Indian indigo. I am told, however, that this Paraguayan shrub has such singular fecundity and vigour that it can be stripped four times a year without injury to the plant. As it requires little care or cultivation this dye plant might some day compete in the European market with that of the Indian indigo."

From botanical specimens of this plant received from Mr. Egerton in 1885 Professor Oliver was able to express an opinion that "it was " identical with a plant sent by Balansa from Paraguay as an indigo-" producing plant called in Guarani *Urubu-retina* and placed with " *Eupatorium læve*, D.C. To this species it is certainly allied, if not " indeed a mere state. Pohl has left a manuscript name *E. tinctorium* " (folia tincturam cœruleam ei Indigofera Anilis similem præbent)". In the *Flora Brasiliensis*, vi., pt. 2, 352, Mr. J. G. Baker has reduced Pohl's name as a synonym under *Eupatorium læve*, D.C., the name here adopted for Mr. Egerton's plant. The material sent over to this country did not allow of a trial being made to test the yield and value of the indigo. Last year the subject was again revived.

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ROYAL GARDENS, KEW, to FOREIGN OFFICE.

SIR, Royal Gardens, Kew, 15 April 1891.

I AM desired by Mr. Thiselton-Dyer to inform you that in an extract from a Despatch from Her Majesty's Chargé d'Affaires at Buenos Ayres, dated 31st July 1881, communicated to this establishment in your letter of the 1st September of the same year, reference is made to a blue dye prepared from *Eupatorium tinctorium*, a Paraguayan shrub.

2. It is said that "this dye is a little darker than indigo, but other-" wise extremely good. A small sample of it lately sent to France " brought 12 francs when the Indian indigo was sold for 15 francs."

3. Nothing further appears to have been done to investigate this substance. Mr. Thiselton-Dyer has, however, recently been in communication with the Department of original research in dyeing at the Yorkshire College, Leeds, and he is informed that this Department is prepared to investigate the matter provided an adequate supply of material, consisting of the leaves of the plant, could be forwarded direct to Leeds for that purpose.

4. Mr. Thiselton-Dyer would recommend, with the approval of the Secretary of State, that the subject be brought to the notice of Her Majesty's Minister at Buenos Ayres, who may be disposed to assist in the investigation of an interesting subject.

I have, &c.
(Signed) D. Morris.

Sir Villiers Lister, K.C.M.G.,
Foreign Office, S.W.

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In December last a case containing a supply of leaves was received at Kew and forwarded to Professor Hummel, of the Yorkshire College, Leeds. It may be mentioned that the leaves were in a dry condition, and thus they did not afford the best condition for being tested for indigo. The result is contained in the following report which has been obligingly communicated to this establishment.

The conclusion arrived at clearly shows that the leaves must be worked on the spot in a fresh state. There is undoubtedly indigo in the leaves, and the plant might be utilised locally for supporting an important indigo industry in the new world. The plant is singularly hardy, and, as suggested by Mr. Egerton, " it might some day compete " in the European market with Indian indigo."

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Professor Hummel to Royal Gardens, Kew.

The Yorkshire College, Leeds,
14 June 1892.

Sir,

* * * *

With respect to the *Eupatorium tinctorium* leaves received some time ago, I find they yield an extremely small quantity of indigo, no doubt owing to the decomposition of the "indican" originally present. I sent a sample of the leaves to Dr. Schunck, who is our greatest authority on this subject, and he wrote me as follows:—

"The leaves certainly do contain indican but the quantity is very small. I tried several ways of obtaining, not indican, but the indigo representing it, from the leaves, but all the methods except one gave next to nothing. This method was as follows:—The pounded leaves separated from the stalks, &c. were stirred up with cold water and the extract after standing for some time was strained through calico. To the yellow extract a small quantity of sugar of lead solution was added, the dirty yellow precipitate was filtered off and to the yellow filtrate an excess of hydrochloric acid or a little nitric acid was added. On standing, indigo blue separated; this was filtered off and treated first with boiling water and then with caustic lye, then dried. In this way the enclosed specimens were obtained, each from 100 grains of leaves, No. 1 using HCl. and No. 2 using $HNO_3$. In my opinion the only way of ascertaining the value of the leaves for producing indigo is by working them up while fresh at the place where the plant grows."

I am, &c.
(Signed) J. J. Hummel.

The Director,
Royal Gardens, Kew.

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## CCLVI.—FAHAM TEA.

(*Angræcum fragrans*, Thouars.)

There are so few species of orchids possessing economic value, that the order as a whole is valued chiefly for the beauty and singularly diversified forms of its flowers. Amongst orchids yielding economic products, the most important are the Vanillas, of which *Vanilla planifolia*, a native of Mexico, is the species most commonly cultivated. The fruit of another American orchid, *Selenipedium chica*, according to Seemann (Bot. Herald, p. 215), "is highly esteemed as an aromatic by the "inhabitants of the Isthmus of Panama, and used for all purposes for "which real vanilla is commonly used." A few species of the genus *Orchis* yield from their bulbs a starchy mucilaginous substance known as Salep. The leaves of *Goodyera pubescens*, a North American orchid, have been used in the cure of scrofula. The roots of *Corallorhiza odontorhiza*, known as Coral or Crawley root, have a strong peculiar odour, and are used as a diaphoretic and sedative. The roots of the yellow Lady's Slipper or Moccasin flower (*Cypripedium pubescens*), also a native of North America, are used as a tonic and stimulant medicine, while a small epiphytical orchid, the subject of the present notice, a native of Mauritius and Réunion, yields an odoriferous principle from its leaves. This latter is *Angræcum fragrans*, Thouars, known locally under various names as Faham and Fahum, and specially interesting on account of the persistent vanilla-like odour of the leaves, which has led to its use as a tea in Bourbon or Réunion, the Mauritius, and even to some extent in France. The plant is epiphytical on trees in the forests of Réunion and Mauritius. It is perennial and produces a few narrow green leaves and fragrant white flowers. The flowering season is during the months of February and March. Plants of this species were received at Kew from Mr. John Horne, F.L.S., Director of the Botanical Gardens, Mauritius, in 1887. These flowered in this country in January 1890, and a figure was prepared for the *Botanical Magazine*, t. 7161 (1891).

The following note "on the odoriferous principle of the leaves of *Angræcum fragrans*" by M. Gobley in the *Chemical Gazette* is quoted in the *Gardeners' Chronicle*, 1850, pp. 599–600:—

"The leaves of Faham, known also by the name of Fahon or Fahum leaves, are imported from the Mauritius; they are obtained from a plant first described by Dupetit-Thouars under the name of *Angræcum fragrans*, belonging to the *Orchideæ*. Like many of the exotic orchids, the Faham is parasitic. It is a charming plant, and much sought after by the Asiatics on account of its fragrance. It is sufficient to touch the fresh leaves for the fingers to remain impregnated with the aroma. The dry leaves, which occur in commerce, have an odour which considerably resembles that of the Vanilla, belonging to the same family of plants. Alchohol and ether separate the aromatic principle; boiling water removes a slightly bitter principle and a mucilaginous substance, besides the aroma. In the country whence they are derived, and even in France, a very agreeable tea is prepared from them, which is used as a digestive, and even recommended in diseases of the respiratory organs. Mixed with ordinary tea, they impart to it an extremely ageeable perfume."

Under the title of "orchid tea" a further account was given by Mr. J. R. Jackson, A.L.S., of the same plant in the *Gardeners' Chronicle*, 1866 (1), p. 315:—

"The plant yielding the new orchid tea is *Angræcum fragrans*, Thouars, an epiphytal orchid of the Island of Bourbon, where it is known and used by the natives under the name of 'Faham.' This word, once an obscure native name, is now, if we are to believe the enterprising French firm who has just introduced it, destined to become a 'household word,' for 'Faham' is the name under which it is now sold in Paris, and the word appears in large letters upon the boxes in which it is packed, as well as upon the circulars accompanying them. The headings of these circulars run as follows:—'Faham from the Isle of Réunion.' There is also a rough, but not at all a bad cut of the plant producing it. The circular itself begins by saying that tea proper has never been well received in France, owing to the wakefulness resulting from its use, which has caused many persons to reject it altogether, while many of those who do use it, drink it in default of a better substitute. Faham is not a new production. From time immemorial the natives of the islands of Réunion and Mauritius, though situated, as it were, at the very gates of China, have preferred it to tea; every traveller has partaken of their preference; George Sand eulogises it in the fine description which she gives to the Isle of Bourbon, an eulogy which was written years before the introduction of Faham into France was thought of. The difficulties experienced in the gathering and manufacture of Faham on a large scale, and its very high price, have alone prevented it from being imported into France. After many fruitless attempts, these obstacles have been overcome.

"Faham grows upon the high slopes of the Island of Réunion, in the midst of almost inaccessible forests. It possesses a taste differing greatly from that of tea, but is preferred by the majority of persons who have tasted it. It possesses an aroma of great delicacy, capable of being rendered more or less pungent, according to the quantity used, and it gives forth a most agreeable perfume; after being drunk it leaves a lasting fragrance in the mouth, and in a closed room the odour of it can be recognised long after. This beverage has the further advantage over tea, which requires to be drunk at the time of making, that it can be reserved for a future occasion if requisite, and may either be taken cold or made hot again. Milk, or spirits in small quantities, especially rum, serve to develop its aroma. Lastly, this valuable plant is made use of to flavour custards and ices, to which it communicates its delicate fragrance.

"To be taken as a warm beverage, the leaves and stalks should be placed in cold water, in about the proportion of one gramme to a teacup, more or less, as the consumer may desire it of a greater or less degree of strength. The water should be immediately made to boil for about the space of 10 minutes in the tea kettle or other closed vessel. It should then be emptied into the teapot or teacups, and sweetened accordingly."

A sample of this new kind of tea has recently been received at the Kew Museum; it was packed in a very neat, canister-shaped box, similar to those now sold in Paris. These boxes are of two sizes, the smaller containing material sufficient for making 50 cups of Faham, and sold at 2 f. 50 c., and the larger 105 cups, and sold at 5 f. Upon opening the box the perfume emitted was exceedingly powerful, and very similar to the Tonquin bean. The leaves, unlike those of tea, appear simply dried, not shrivelled by heat, but are as flat as we should find them in any herbarium. The absence of any artificial colouring matter, or roasting, accounts for the very light colour of the infusion.

In the Museum of the Royal Gardens at Kew are some cigars made of the leaves of *A. fragrans* simply rolled in a thin tobacco leaf. They are probably very agreeable smoking, but I am unable to say if this application is a common one in the Island of Bourbon, or whether these specimens are merely a curiosity.

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## CCLVII.—FALSE SISAL OF FLORIDA.

(*Agave decipiens*, Baker.)

In the *Kew Bulletin* for February last, pp. 21–40, a general account was given of the Sisal Hemp industry, and particulars were given of the distribution of Sisal Hemp plants in nearly every part of the world. In the description of the plants found in Florida it was pointed out that the bulk of these consisted of the best sort for fibre (*Agave rigida*, var. *sisalana*), in every respect similar to the plants now being so largely planted in the Bahamas, Turks Islands, Jamaica, and elsewhere. Amongst the Florida plants Mr. Charles Richards Dodge, an officer of the United States Department of Agriculture, found here and there some plants which were evidently not true Sisal. For instance, "at Juno, about "ten miles further south (from Jupiter), at the head of Lake Worth, "I found another fine nursery of perhaps a hundred thousand plants, the "property of Mr. A. M. Fields, who is quite enthusiastic on the subject. "Fully fifty per cent. of his plants are not *Agave sisalana*, however, "but a species which was subsequently met with at many points along "the east and west coasts as well as on the Keys—doubtless *Agave* "*mexicana*."* At the time this was quoted in the *Kew Bulletin* (p. 26) it was stated that probably this determination would require to be verified. Since that time abundant material has been received at Kew from Florida from Mr. Richards Dodge, and there is no doubt that the plant which he had provisionally taken to be *Agave mexicana*, and mentioned in his report under the name of "False Sisal," was an entirely new species. In a letter dated April 27, 1892, forwarding specimens, Mr. Richards Dodge states :—

"Department of Agriculture, Washington,
April 27, 1892.

"I have just received from Biscayne Bay, Southern Florida, some blossoms of my so-called 'false Sisal,' accompanied by mature leaves taken from the same plant. One of these I send you by mail to-day, the others being in a semi-decayed condition and unfit to send. This is the normal length of the leaves found throughout the Biscayne Bay region and along the line of Keys. Those at Lake Worth, which is very near to Jupiter, I found with leaves at least a foot longer, in rare instances two feet longer, though preserving the same characteristics. I send you with this a few blossoms, together with a sample of true Sisal hemp, and another of false Sisal for comparison with it. As you will see, one is a strong, good fibre, the other is not more than half as strong, and of different appearance."

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* Sisal Hemp Culture in the United States. Fibre Investigations. Report No 3, 1891, p. 41.

These and other specimens have enabled Mr. J. G. Baker, F.R.S., the Keeper of the Herbarium at Kew, to draw up the following description of the plant:—

### Agave (Euagave) decipiens, Baker.

Caudice demum 3–4-pedali, foliis dense rosulatis ensiformibus rigidis demum 4-pedalibus utrinque levissimis viridibus infra medium ad apicem sensim angustatis, facie sæpissime concavis, spinâ terminali pungente breviter decurrente, aculeis marginalibus parvis atro-castaneis deltoideo-cuspidatis, floribus in paniculam amplam thyrsoideam dispositis, ovario oblongo, perianthii tubo brevi late infundibulari, lobis tubo duplo longioribus, staminibus longe exsertis, stylo staminibus demum æquilongo.

Hab. Florida, Biscayne Bay, and Lake Worth. For all the material from which the plant is described we are indebted to C. R. Dodge, Esq., the special agent for fibre investigations of the United States Department of Agriculture. It is the plant "supposed to be *A. mexicana*," figured on plates 7 and 8 of his report, No. 3, issued May 1891.

*Caudex* reaching a length of 3–4 feet, whilst *A. sisalana*, over the same area, remains nearly acaulescent. *Leaves* densely rosulate, very rigid, ensiform, reaching a length of 4 feet, broadest a little below the middle, where they reach 3½–4 inches, narrowed very gradually to the horny brown pungent point, which is ½–¾ in. long, and decurrent as a narrow brown-black line along the edge of the leaf for 3–4 inches, narrowed also to a point above the diluted base, where they are 2½ in. broad, very smooth and apple green on both surfaces, not distinctly glaucous even when young, usually very concave all down the face and convex on the back, rarely flat; marginal prickles moderately close, deltoid, cuspidate, brown-black, not more than a line long.

*Peduncle* with panicle about five times as long as the leaves. *Panicle* 8–10 feet long, with a rather flexuose axis, and usually single dense clusters of flowers terminating the laxly-disposed simple arcuate branches.

*Flowers* arranged in dense clusters. Ovary oblong, finally 2 in. long, ¾ in. diam. *Perianth* greenish-yellow, an inch long; tube broadly funnel-shaped; lobes complicate lanceolate from a dilated base, twice as long as the tube. *Stamens* 18–21 lines long, inserted at the middle of the perianth tube; anthers linear, ½ in. long. *Style* finally reaching to the top of the stamens.

Belongs to the section *Rigidæ* and nearly allied to *A. rigida* var. *A. elongata*, Jacobi, from which it differs by its longer caudex and concave-faced leaves, which are very smooth on both sides, and not at all glaucous even when young, broadest below the middle, and narrowed very gradually to the hard point, which is decurrent for a short distance as a narrow brown-black border. The fibre which it yields is very inferior in tenacity to that of *A. sisalana*. I cannot make out any material difference between the flowers of the two species. The name *decipiens* refers to the plant being confused so easily with the forms of *A. rigida*, of which the fibre is so much more valuable that it would lead to loss and disappointment if it were cultivated for economic use.

J. G. Baker.

## CCLVIII.—VINE DISEASE IN GREECE.

The currants of commerce are obtained from the Black Corinth or Zante grape vine. This is a variety of the common vine, with stoneless or seedless fruit. The plant is chiefly cultivated on the mainland of Greece and the Ionian Islands, and the annual value of the exports amounts to about a million and a half sterling.

Latterly the plants yielding commercial currants at Pyrgos, on the west coast of Greece, have been attacked by disease, and Her Majesty's Vice-Consul in that district has furnished the following report, which has been obligingly communicated to Kew by the Foreign Office:—

FOREIGN OFFICE to ROYAL GARDENS, KEW.

SIR, Foreign Office, June 17, 1892.

I AM directed by the Secretary of State for Foreign Affairs to transmit to you, to be laid before the Director of the Royal Gardens, a report on the vine disease at Pyrgos in Greece.

I am, &c.

The Assistant Director, (Signed) JAMES W. LOWTHER.
Royal Gardens, Kew.

Enclosure.

REPORT of Mr. Vice-Consul FAUQUIER, of Pyrgos, on a Disease of the Currant Vines in his Vice-Consular District.

Yesterday I went on an inspecting tour to see if the complaints of the currant disease are, or are not, exaggerated. My impression is that there are localities that are literally devastated, not a bit of exaggeration, others to the extent of 50 to 60 per cent., and those that have suffered less have a damage of 10 to 20 per cent. It is, therefore, to be understood that the evil has spread more or less all over the district.

If it makes no further progress (but it shows no sign of abatement, and there is too much moisture in the atmosphere) the damage thus far done in Pyrgos and Olympia is very serious, probably one-third to one-half of the crop, and probably more, but of course one must be careful in quoting figures.

As to the damage being at least one-third of the crop, there can be no doubt whatever.

(Signed) CHARLES FAUQUIER,
Vice-Consul.

Pyrgos, 6 June 1892.

## CCLIX.—MISCELLANEOUS NOTES.

MR. WILLIAM TRUELOVE retired from the service of the Royal Gardens, Kew, on April 30th last, after serving 26 years as foreman of the Arboretum, a position which he filled with great credit to himself and satisfaction to his superior officers. Before coming to Kew Mr. Truelove had charge of the then famous Bicton Arboretum, and his selection

to fill the post from which he has retired, has been justified in every way. From small beginnings—the number of ligneous plants cultivated in the open air at Kew was comparatively very small 26 years ago—the Kew Arboretum has developed to a considerable extent; at the present moment it contains about 3,000 species and named varieties—excluding garden varieties of such plants as Roses, Rhododendrons, Hibiscus, &c.

The Superannuation Act of 1887 having practically abolished the pensions to which men in Mr. Truelove's position were formerly able to look forward, he was on retirement only entitled strictly to the gratuity of 47*l.* 10*s.* which the Treasury awarded him. But in consideration of his exceptional services the First Commissioner was pleased to make a special application on Mr. Truelove's behalf to the First Lord of the Treasury. This obtained for him a further grant, though it was expressly stipulated that this was not to be regarded as a precedent for the future. The Board recorded the award in the following minute:—

Director of Kew,
To inform Mr. Truelove.

In dispensing with his services the Board desire to record their appreciation of the diligence and skill which he has shown in the discharge of his duties during the period that he has been in their employ. It is to a large extent in recognition of this that the First Commissioner recommended, and that the First Lord of the Treasury has granted, an additional gratuity of 120*l.* from the Special Service Fund.

17th May 1892. H. W. P.

Mr. W. J. Bean succeeds Mr. Truelove as foreman in the Arboretum. Mr. Bean first entered the Kew service from the gardens of Belvoir Castle on April 2nd, 1883. He was not long before rising to the rank of sub-foreman, and on the retirement of Mr. Binder in 1888, Mr. Bean became foreman of the Temperate House.

Mr. Thomas Jones fills the post of foreman of the Temperate House vacated by Mr. Bean. Mr. Jones came to Kew as gardener on January 2nd, 1888, from the Nurseries of Messrs. James Dickson & Sons, of Chester. In July 1889, he was promoted sub-foreman in the Palm House.

Borassus flabelliformis.—Kew is indebted to His Highness the Gaekwar of Baroda for a healthy young specimen of this, the Palmyra Palm, which has lately been received and may now be seen in the Palm House. Hitherto all attempts to grow this palm to any size at Kew have failed, although we have now healthy seedlings which were raised from seeds presented by the Right Hon. Sir M. E. Grant-Duff, G.C.S.I., in 1886, when Governor of the Madras Presidency. The specimen from Baroda has a trunk 2 feet in diameter and 4½ feet in length, and although its roots perished on the journey, it is otherwise in good condition. It had been lifted and carefully packed by Mr. Henry, the Superintendent of the Baroda Gardens. We are also indebted to Mr. W. Goldring, who kindly interested himself in this matter whilst at Baroda, where he is engaged in laying out new Parks and Gardens for the Gaekwar.

A new house for FILMY FERNS has just been erected on the north side of the large Fernery (No. 2), and the plants removed from the old house (No. 3), which is to be replaced by one more suitably adapted for the cultivation of Temperate Ferns. The Filmy Fern House is 50 feet by 14 feet, with a central path and two cases running the full length of the house. The Cooper-Forster collection is now incorporated with the Kew plants, the whole forming an exceptionally rich collection of these delicate little ferns.

A very extensive and valuable series of products illustrating the varied uses of the BAMBOO IN JAPAN has recently been presented by Charles Holme, Esq., F.L.S. It has been arranged in two cases in Museum No. III., and shows at a glance both the ingenuity of the people in adapting this valuable arboreal grass to their daily wants, and the suitability of the bamboo stem to the purposes to which it is put.

This collection worthily supplements the large and interesting set of bamboo products from various tropical countries previously shown in the classified collection in Museum No. II.

Another interesting though temporary addition to Museum No. III. is a framed set of 21 large photographs representing views of tropical scenery and plants in the Island of GRENADA, taken by R.V. Sherring, Esq., F.L.S., whilst investigating the Cryptogamic Flora of that Island for the West Indian Exploration Committee of the Royal Society and British Association. Mr. Sherring has deposited the collection on loan for a short time.

MAHOGANY IN FIJI: Seeds of the valuable Mahogany tree have been distributed from Kew to all parts of the world. One of the latest recipients was the Colony of Fiji. In a letter received from the Curator of the Botanical Station at Suva in March last it is stated, that 700 plants had been raised from Kew seed, and several cases containing Mahogany plants had been forwarded to the district Magistrates in order to establish this valuable timber tree through the group. It is further mentioned that 150 plants had been put out in and near the garden, some of which were 12 to 14 feet in height. A good number was still on hand, but, of these, the Governor, Sir John Thurston, hoped to utilise many to plant along a new road proposed to be opened through the mountains.

A very remarkable GOUTY-STEMMED BALSAM was lately figured and described in the *Botanical Magazine*, t. 7195, from the east coast of Sumatra, under the name of *Impatiens mirabilis*, Hook. f. The perennial stem is about 4 feet in height, and the thickness of a man's leg. It has large yellow flowers produced on short lateral racemes. There are several living plants in the Kew collection, one of which is in flower now (July 1892). The following additional information respecting this balsam has been forwarded to this establishment by its discoverer, Mr. Charles Curtis, Assistant-Superintendent of the Gardens and Forest Department, Straits Settlement, in a letter dated Penang, May 3rd, 1892:—" I have recently been to the Langkawi Islands, where

" I obtained many interesting plants, a set of which has been put aside
" for your herbarium. I saw some fine specimens of *Impatiens mirabilis*,
" Hk. f. with stems 5 feet high, 22 inches in diameter at the base, and
" with 20 or more branches, each having 2-3 expanded flowers and
" numerous buds. It grows in places difficult of access, on sharp-pointed
" limestone rocks that cut like knives. It appears to lose its leaves
" entirely during the dry season, and was only just commencing its
" growth when I was there last month."

In addition to the Vascular Cryptogams collected under the auspices of the West India Exploration Committee by Mr. R. V. Sherring, F.L.S., and described in the *Annals of Botany*, Vol. VI. No. 21, April, 1892, by Mr. J. G. Baker, F.R.S., his collections have yielded about thirty species of ORCHIDS FROM GRENADA, some of which are of considerable interest. These have now been determined by Mr. R. A. Rolfe, A.L.S. The orchids of Grenada appear not to have been systematically collected before. There is no record of species from that island in Grisebach's *Flora of the British West India Islands*, 1864, and only about three or four were represented in the Kew Herbarium. Mr. Sherring's collections therefore enable us to arrive at a tolerably good idea of the distribution of orchids in the island. A species of *Brachionidium*, a genus not hitherto represented in the West Indian flora, is probably new, as also species of *Scaphyglottis* and *Cranichis*. *Hexisia reflexa*, *Pleurothallis pruinosa*, and *Ornithocephalus gladiatus* have not hitherto been found in the smaller islands, the recorded specimens being chiefly from Jamaica and Trinidad. *Oncidium luridum*, one of the most striking of West Indian orchids, with spikes 5 or 6 feet long, is established also as a Grenada plant. *Dichæa hystricina* has not been found before except in Cuba by Wright and Eggers. *Xylobium* (*Maxillaria pallidiflora*) was recorded before only from St. Vincent, and *Elleanthus lepidus* is new to the West Indian flora. The remaining species are found in many islands, such as Jamaica and Dominica, but their occurrence still further south is a point of some interest. Of Mr. Sherring's general collection a number of Phanerogams have still to be worked out.

Mr. J. F. Duthie, F.L.S., Director of the Botanical Department, Northern Indies, writes as follows from Saharunpur, dated 27th February, 1892 :—

" It may interest you to hear, should you not already have been informed, that SUGAR CANE has been FLOWERING freely this season in various parts of India. In this district, flowers have been abundantly produced as well as in those of Etáwah and Cawnpore; and a similar report comes from the Poona district of the Bombay Presidency. I have made arrangements for securing as much seed as possible for raising stock ; and a note of mine in the 'Pioneer' newspaper will no doubt induce others, who have an interest in sugar cane cultivation, to do the same.

" I find on inquiry, that seven years ago a few flowering specimens of sugar cane were observed in this district ; but it is 22 years since such an abundant harvest of flowers has been known as that of this year. The native cultivators are much exercised in their minds over this sudden and unusual development, and look upon it as a sure sign of some impending calamity. In this district, none of the 'paunda' or thick-stemmed kinds, used for chewing, have flowered this year ; but of

the hard-stemmed varieties from which sugar is made, the following have flowered: Kannar, Lábri, Ghorruh. I am sending by this week's mail flowering specimens of each of the above, and next week I will send you some seed."

The sugar cane seed promised by Mr. Duthie, was duly received at Kew. It was sown on two occasions and carefully watched, but none of it germinated. It is quite possible that in India, as in the West Indies and Java, some varieties of sugar cane may produce seed, but the experience at Kew with Indian seed appears to confirm the results given in the Annual Report of Government Botanical Gardens, Saharunpur, for the year 1891, p. 10, and is purely of a negative character.

The recent hurricane at MAURITIUS appears to have been equally destructive to vegetable life, and the beautiful Botanical Gardens in the island have been almost completely destroyed. Photographs of different portions of these gardens taken immediately after the cyclone show nothing but heaps of wreckage, where once majestic palms, feathery tree ferns, and lovely orchids flourished only a few hours before. Mr. William Scott, the Acting Director, writes as follows on the 12th May last:—

"Since I wrote to you last we have had a sad disaster here. A cyclone of terrific force swept over the island on the 29th April, and almost laid it in complete ruins. Hundreds of people have been killed and wounded, and thousands are homeless. One-third of the town of Port Louis is a heap of ruins. The sugar canes have been levelled and their leaves thrashed into fibre. The Gardens at Pamplemousses are a complete wreck, the oldest and finest trees have been uprooted, and the trees that are still standing are reduced to bare poles. The fruit trees have been so smashed up that I can hardly recognise them. I have sent you a photo of my house showing a little of the wreck. I shall send you some more when I can get them. In some parts the wreckage is piled up nine feet high, and it will be months before we can get it cleared away."

The following further information respecting the Sisal Hemp or Pita cultivation in the Bahamas is given in the Governor's Report on the Blue Book for the year 1891 (Colonial Reports, No. 44, 1892):—

"Fibre cultivation makes very satisfactory progress, and there are now about 8,000 acres planted out. At least 6,000 acres will be added to this area in 1892. A larger addition would be made but that the supply of plants of the requisite growth is yet limited. It is now ascertained that it is not advisable to transplant from the nurseries until they are at least one year old, and have attained to a length of 12 or 15 inches. The nurseries, however, are in full operation, and I believe that after the present year the supply of plants will be equal to any supposable demand. The adoption of the limit which restricts Crown allotments for 10 years to 100,000 acres, assures present investors against risk of over-production in the near future at least. The export from early plantings has now begun, and will be about 150 to 200 tons in 1892, and this will thereafter be an increasing quantity, but a careful estimate shows that it will not reach beyond 14,000 to 15,000 tons up to the year 1900. The subsequent advance will be much more rapid, but in no reasonable view of the circumstances can the export from the Colony have a marked effect on the market for many years to come. It is now ascertained that, with plants of fair growth, four years is the

longest time for the maturing of the plant, and it then yields an annual crop, without further care, for 12 or 14 years. I do not approve of forcing the crop, and immature cuttings are to be specially deprecated. The fibre is at its best after due time has been given for its growth, and unwise methods will be carefully dealt with by the Government in the highest interests of the Colony. There is much yet to be learned in connexion with this enterprise, but it is satisfactory to know that, with our present imperfect knowledge, no serious mistakes have been fallen into. Experience will no doubt lead to a lessened expense of cultivation, especially in the matter of weeding that has hitherto been a large item, but in which it now appears a reduction may be made. The highly important question of labour is well guarded, and the whole quantity of one hundred thousand acres may be brought into cultivation without strain on our present resources. The plant, being confessedly the best of any known growth, a demand from abroad has set in, and, though there are well considered doubts of its successful growth in some places where an attempt to cultivate the plant is being made, there seems no reason why any amount of competitive industry should be encouraged, and for this and other reasons the Act passed three years ago, to prohibit the export of plants, has now been extended for five years more. The available supply at present is not more than is required for the operations in the Colony, which would be hampered by outside demand, and the progress of the Colony be consequently retarded. It would be difficult to assign a limit to the future advance of the Colony from the growth of this remarkable industry. Though the land provisionally assigned to fibre cultivation (one hundred thousand acres) will in time yield 50,000 tons there seems no reason why even this great result should bar the extension of the area of production, if the markets of the time shall admit of its profitable disposal. It is generally thought that, from the excellence of the fibre, it will find its way into other fields for its use besides rope-making, and recent experiments prove that it takes a dye readily, indicating its adaptability to certain fabrics, and to some extension of demand on this account. There is the further ground for the probably strong place for Bahamas hemp in the future, that it can be produced more cheaply than any known fibre of equal value, and it may be inferred that it will hold its own at least against the influence of any probable competition with which it may have to contend."

ROYAL GARDENS, KEW.

# BULLETIN

OF

# MISCELLANEOUS INFORMATION.

No. 69.] SEPTEMBER. [1892.

## CCLX.—CARAGUATÁ FIBRE.

(*Bromelia argentina*, Baker.)

Under the name of Caraguatá the late Mr. Thomas Routledge forwarded to Kew, in 1877, for determination, "the leaves of a plant "from the Argentine Republic, with the remark, that the 'fibre when "abstracted no doubt will make good paper.' After some trouble, we "arrived at the conclusion that the leaves belonged to one of the "singular South American species of *Eryngium*, which have before "flowering quite a Bromeliaceous habit." [Kew Report, 1877, p. 37].

A few years later Mr. Edwin H. Egerton, C.B., then Her Majesty's Chargé d'Affaires at Buenos Ayres, referred to the Caraguatá plant in a report forwarded to the Foreign Office, dated 31st July 1881, as follows:—"But by far the best fibre of the country is that of the "Caraguatá Ibera, a Bromeliad which is something like the Pine-apple "plant, and which is very abundant in Paraguay, the Misiones, and the "Chaco. It is very long and silky, and has long been used by the "Indians, and much money has already been spent in endeavours to "find some practical machine for the economical preparing of this "fibre. I am assured that the desired result has now at length, after a "long series of experiments, been attained by a French machine "invented for the purpose which has just been set up not very far "from Asuncion, the process being a simple one without previous "maceration.

"Should this invention prove a success (and I am promised further "particulars from the persons undertaking this work) the caraguatá "fibre will become an extremely important article of export, and if half "I hear of it be true, should compete with advantage against jute.

"I am assured, but I cannot vouch for the assertion, that there is "immense superiority in the quality of the Paraguayan fibre over that "of the Chaco and Misiones caraguatá."

In 1884, Mr. F. E. Harman, who had undertaken a mission to the Plate River for the Santa Fé Land Company, brought with him numerous species of Argentine grasses, which were determined at Kew, and also some living plants of what were believed to be Caraguatá from the Gran Chaco. With these plants, Mr. Harman brought a dried specimen of an infloresence. The plants have grown at Kew, and are now in a flourishing condition in the Temperate House. As will be shown later, they are not true Caraguatá, and they possess no merit as fibrous plants. On the other hand the dried infloresence, brought at the same time, belonged to the fibre-producing species. It is probable that the name Caraguatá is used in a generic sense in the Argentine and neighbouring countries; and, as already shown, it is applied indiscriminately to plants of a very widely different character. There is, however, a plant known as Caraguatá or Caraguatá Ibera, which yields a very valuable fibre. It has been noticed in works of travel, and its valuable properties have been highly extolled. The difficulty was to obtain authentic specimens of the true fibre-yielding plant, and find out exactly what it was. Under these circumstances a further, and as it proved a successful, effort was made to obtain specimens as shown in the following correspondence:—

### Royal Gardens, Kew, to Foreign Office.

Royal Gardens, Kew,
November 20, 1889.

Sir,

I am desired by Mr. Thiselton-Dyer to inform you that in the year 1877 the late Mr. Thomas Routledge forwarded, for determination, to Kew some fibre and leaves of a plant from the Argentine Republic known locally as Caraguatá. The leaves were broken and in an imperfect condition. Moreover, it was considered doubtful whether they belonged at all to the plant which yielded the fibre. The leaves, as far as could be ascertained from the scraps sent, belonged to a species of *Eryngium*. (Kew Report, 1877, p. 37.)

2. At the recent *Exposition Universelle* held at Paris in 1889, I noticed in the Paraguayan Court some leaves and fibre called Caraguatá said to be derived from *Bromelia Caraguata*. There is no plant known to European botanists under this name. The Caraguatá of Paraguay is a plant which it is very desirable to investigate, and specimens of it in a living and dried state would be very acceptable for the collections at Kew.

3. Mr. Thiselton-Dyer ventures to express the hope that the Secretary of State will approve of the kind offices of the Minister at Buenos Ayres being invited to procure information respecting the Caraguatá plant, its distribution, and local uses, and also small specimens of living plants, packed in a dry box, and seeds for this establishment. For a botanical determination of the plant, it is desirable to obtain dried specimens of the leaves, flowers, and fruit. These latter might be forwarded by post between sheets of paper protected by cardboard.

4. Any reasonable expense, incurred on account of this service, will be defrayed in usual course.

I have, &c.
(Signed) D. Morris.

Sir Villiers Lister, K.C.M.G.,
Foreign Office.

The Hon. Francis J. Pakenham to Foreign Office.

My Lord, Buenos Ayres, February 3, 1890.

On the receipt of your Lordship's despatch of this series, No. 39, of the 25th of November last, instructing me to procure specimens of the Caraguatá plant for the Royal Gardens at Kew, I communicated its contents to Dr. Stewart, Her Majesty's Consul at Asuncion, from whom I have received the reply of which copy is enclosed.

The box containing the specimens in question reached me a few days ago, and I have the honour to transmit it to your Lordship herewith, unopened, as it arrived.

I have, &c.

The Marquis of Salisbury, K.G. (Signed) F. Pakenham.

[Enclosure.]

Sir, Asuncion, January 12, 1890.

I beg to acknowledge the receipt of your letter of the 27th ultimo, and enclosed copy of a letter, dated 20th November, Royal Gardens, Kew.

By the steamer "Saturno," of the Platense Company, I have the pleasure to send to you this day a box containing samples of the Caraguatá plant, and of its fruit and inflorescence, which I hope will prove satisfactory for the purpose of determining its scientific classification.

I have, &c.

(Signed) William Stewart, M.D.

The Hon. F. J. Pakenham.

The material obtained through the Foreign Office, as shown above, and that obtained upon a subsequent occasion from Dr. Stewart direct, were submitted to Mr. J. G. Baker, F.R.S., Keeper of the Herbarium at Kew, who has furnished the following account and description of the Caraguatá plant as now known to us :—

We have now received for the first time, through the Foreign Office full material for the botanical determination of this plant, procured for us by Dr. W. Stewart, H.B.M. Consul at Asuncion. It proves to be a true *Bromelia*, nearly allied to *Bromelia Pinguin*. In the monograph of the Brazilian Bromeliaceæ just published by Dr. Mez, which forms part of the great "Flora Brasiliensis" of Endlicher and Martius, two species which are nearly allied to it are described for the first time, viz., *B. Balansæ*, Mez, from Paraguay, and *B. Regnellii*, Mez, from Central Brazil. The latter, which comes nearest to it of the three species, is figured on Plate 53. The description of *Rhodostachys argentina* in my *Handbook of the Bromeliaceæ*, p. 29, so far as regards the inflorescence in a state of fruit, relates to the present plant; but now that we have the flowers, they show that the plant is not a *Rhodostachys*, but a *Bromelia*, and that the leaves that were originally sent with it do not really belong to the same species as the flowers. We are therefore very much indebted to Dr. Stewart for enabling us to clear the matter up, and I give now a full description of the plant under the name of *Bromelia argentina*, drawn up entirely from his latest specimens, received Feb. 10, 1892.

**Bromelia argentina,** *Baker, n. sp.* Leaves like those of *B. Pinguin*, ensiform, rigidly coriaceous, 5 feet long, $1\frac{1}{2}$ inches broad exclusive of the prickles above the dilated base, tapering very gradually to the point; prickles large, deltoid cuspidate, uncinate, brown and horny in the upper half, about an inch apart in the centre of the leaf. Peduncle stout, nearly a foot long, covered by the closely imbricated ovate-lanceolate scariose bract-leaves, the lower of which are about 3 inches long, and the upper 2 inches long. Inflorescence a dense oblong head, which is half a foot long in the flowering stage; lower bracts ovate, toothed at the top, with a bright red lanceolate point; flowers many in each cluster, subtended by a large ovate bract; flower-bracts oblong, acutely keeled, $1\frac{1}{2}$ inches long; ovary in the flowering state oblong, trigonous, tomentose, an inch long, $\frac{1}{3}$ inch diam. Sepals oblong, obtuse, an inch long. Petals red, lingulate, a little longer than the sepals. Stamens and style shorter than the petals. Fruit oblong, coriaceous, $1\frac{1}{2}$ inches long when dried.

It will be noticed that Mr. Baker considers the Caraguatá plant to be nearly allied to the Pinguin (*Bromelia Pinguin*, L.) of the West Indies and Central America. It has also some resemblance, as regards leaf character alone, to *Karatas Plumieri.* The latter is a well-known and valuable fibre plant. It is said to be used by Indians in making the finest hammocks in Central America, Guiana, and Brazil. The fibre of the Pinguin was carefully investigated by the Botanical Department in Jamaica in 1884. The plant covers hundreds of acres in the island, and it would readily support a large industry. Great difficulty was, however, experienced in extracting the fibre by machinery, without maceration, and the results were by no means satisfactory. Several samples were forwarded to London and New York for the opinion of brokers, and the London reports were as follows :—" Poor dull fibre, " gummy, fair strength, value about 20*l*."—" Almost unsaleable in the " form sent, not well dressed, not good colour, and in some parts rather " tender."—" If this was better dressed, it might have a sale here, but " in the present form, when so gummy, it is difficult to form an estimate " of it. It comes from one of those plants that suggest the effect of an " alkali upon it for melting away the gum, to see if a better product " could not be produced."

It is possible that the Caraguatá may yield fibre more closely resembling that obtained from Karatas than from Pinguin. There are specimens of leaves and fibre of all three plants shown in Museum No. II. at the Royal Gardens, and some samples of Pinguin fibre in this collection cleaned by hand are of better quality than those prepared by machinery in Jamaica. The fibres obtainable from species of Bromeliaceæ, including those from the common pine-apple (*Ananas sativus*), as well as from *Karatas*, Pinguin, and the Caraguatá now under consideration, are all of commercial importance; but, like many others, they require suitable appliances for their extraction, and until these are forthcoming they will remain unavailable for any but the most limited purposes.

In regard to the local utilisation of Caraguatá fibre, the following extract is taken from a recent Report by Mr. Arthur Herbert [Foreign Office, 1892. Annual Series, No. 1,006. Diplomatic and Consular Reports on Trade and Finance. Paraguay] :—

" The textile plant called Caraguatá abounds and grows naturally in every part of the Paraguayan Republic.

"In the year 1879 Messrs. Branlio Artecona and Louis L. Lenguas made experiments with machinery that they established in the department of Arroyos y Esterios, having obtained from the Government a concession for the working of this product freely for the space of 15 years in all fiscal lands, and to export the same when manufactured free of duty.

"This industry did not give satisfactory results, owing to the inexperience of those in charge and the imperfection of the machinery. After several fruitless attempts they retired, and their concession lapsed.

"In 1889–90 Mr. Artecona again organised the same industry with modern machinery, and took a contract from the company 'Tejidora,' of Buenos Ayres, for all he could remit. He remitted altogether 400 tons, and the result of the sale might have been remunerative if he had not committed the fault of employing inexpert hands and spent his capital in useless experiments, and he again suspended operations.

"Attending to sundry requests from Europe, certain commercial men have lately remitted samples that arrived in perfect condition, from which a profitable result was obtained; but when they remitted large quantities in the year 1890 it fermented on the voyage, and arrived in Europe in an unacceptable condition.

"The *ibera* is a sort of Caraguatá, and its fibre is of a finer quality than that of its congener, but neither of them has obtained any importance in commerce, owing to the cost of cleaning and separating the fibre from the leaves. Several attempts as above mentioned have been made, but so far without any great success. From the interest which has been awakened in this product in European markets, it would seem to deserve a more serious study, and the opinion seems to prevail that with improved machinery and more skilled administration more profitable results might be obtained.

"The flowers have been sent to Kew with a view to determining their exact species, which I believe is still undefined."

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## CCLXI.—DECADES KEWENSES.

PLANTARUM NOVARUM IN HERBARIO HORTI REGII CONSERVATARUM.

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### DECAS III.

21. **Polyalthia Schefferi,** *Stapf.* [Anonaceæ]; affinis *P. Jenkinsii*, Benth. et Hook. fil., sed foliis basi cuneatis, floribus minoribus extra-axillaribus.

Raised at Kew from seeds sent by Dr. R. H. Scheffer, the late Director of the Botanic Garden at Buitenzorg in Java.

*Rami* novelli parce pilosuli, mox glabrescentes, cortice plumbeo nitido. *Folia* lanceolata circa 6 poll. longa, ½ poll. lata, primo subtus argenteo-pilosa, mox glaberrima, supra nitida, nervis lateralibus 9–11

angulo 50–60° ortis, petiolo crasso $2\frac{1}{2}$ lin. longo. *Flores* extra-axillares interdum foliis oppositi, singuli vel bini, brevissime pedicellati ; calycis lobi parvi, late triangulares, puberuli, decidui ; petala exteriora majora, late ovata, $3\frac{1}{2}$ lin. longa, marginibus subrevolutis viridia, parce pilosula, interiora subtriplo minora. *Carpella* 1–2, in fructu maturo ellipsoidea vel obovoidea, coccinea, $7\frac{1}{2}$ lin. longa, stipite dimidio breviore. Semina singula, globosa.

22. **Synclisia delagoensis,** *N. E. Brown* [Menispermaceæ] ; scandens, ramis retrorse pubescentibus cinereis, foliis petiolatis oblongis ellipticis vel elliptico-oblongis utrinque obtusis apice mucronatis 3–5 nervatis, supra glabris cum nervis impressis pubescentibus subtus sparse petiolisque dense pubescentibus, racemis brevissimis breviter pedunculatis axillaribus vel supra axillaribus 3–4 floris, floribus confertis breviter pedicellatis toto adpresse pubescentibus, bracteis subulatis, sepalis 2–3 seriatis, exterioribus 5–8 liberis anguste lanceolatis acuminatis, tribus interioribus in tubum breviter tridentatum connatis, petalis 6 biseriatis minimis transverse oblongis subtruncatis glabris, staminibus circa 12 in columna toto conjunctis.

*Habitat.*—Near Lourenco Marques, Delagoa Bay, *Bolus* 7632 !

*Folia* $1\frac{1}{4}$–$3\frac{1}{4}$ poll. longa, $\frac{1}{2}$–$1\frac{3}{4}$ poll. lata ; petioli $\frac{1}{4}$–$\frac{3}{4}$ poll. longi. *Pedunculi* $\frac{1}{8}$–$\frac{1}{6}$ poll. longi ; pedicelli $\frac{1}{2}$–1 lin. longi. *Sepala* connata $2\frac{1}{2}$ lin. longa. *Petala* $\frac{1}{3}$ lin. longa.

23. **Synclisia zambesiaca,** *N. E. Brown* [Menispermaceæ] ; *S. delagoensi* similis, sed foliis magis ellipticis nervis utrinque prominentibus, floribus subminoribus, petalis dorso setoso-barbatis, staminibus circa 15–18 in columna conjunctis ; drupa globosa pubescente, putamine osseo basi processu usque ad medium intruso, semine hippocrepiforme exalbuminoso.

*Habitat.*—Near Shupanga, and at Shiramba, Zambesi, *Kirk !*

*Folia* $1\frac{1}{2}$–3 poll. longa, $\frac{7}{8}$–$1\frac{1}{2}$ poll. lata ; petioli $\frac{1}{3}$–$\frac{3}{4}$ poll. longi. *Pedunculi* masculi 1–2 lin. longi, feminei in fructu $\frac{1}{8}$–$\frac{1}{3}$ poll. longi ; pedicelli 1–2 lin. longi. *Sepala* connata 2 lin. longa. *Petala* $\frac{1}{4}$ lin. longa. *Drupæ* $\frac{1}{2}$–$\frac{5}{8}$ poll. diam.

These two new species of *Synclisia* are readily distinguished from the only other known species of the genus (*S. scabrida*), by the leaves being entire at the base, and the stamens united into a distinct column. In *S. scabrida* the leaves are cordate and the filaments are nearly or quite free. In all the flowers of *S. zambesiaca* that I have examined I found at least some of the petals furnished with a few stiff hairs on the back near the apex, the hairs being as long as the petals themselves ; but in *S. delagoensis* I failed to find any trace of such hairs. When the genus was founded by Bentham the female plant was unknown, and even now there are no specimens with female flowers at Kew, but a fruiting specimen of *S. zambesiaca* shows that the peduncles bear three or four flowers on short pedicels. The drupes are rather large and appear to have a rather thick fleshy mesocarp ; the endocarp (putamen) is very hard, and $\frac{1}{2}$–$\frac{3}{4}$ of a line thick, being much thicker than in most other genera of the order Menispermaceæ.

24. **Anerincleistus Curtisii,** *Stapf.* [Melastomaceæ] ; habitu *A. hirsuti,* Korth., sed floribus minimis in inflorescentia umbelliformi dispositis.

*Hab.*—Penang, *C. Curtis* (a. 1885), 412.

*Rami* juniores petioli et inflorescentia velutino-tomentosi. *Folia* inaequalia, majora oblonga, $2\frac{1}{2}$–$3\frac{1}{2}$ poll. longa, 1–$1\frac{1}{2}$ poll. lata, basi rotundata subsymmetrica, acuminata, 3–5-plo-nervia, transverse venulosa, utrinque fulvo-setulosa, petiolo $2\frac{1}{2}$–5 lin. longo; minora consimilia, $1\frac{1}{4}$–$1\frac{3}{4}$ lin. longa, brevius petiolata. *Inflorescentiæ* ex axillis foliorum minorum, pedunculo gracili $\frac{3}{4}$–1 poll. longo suffultae, umbellatim cymosae, pauciflorae. *Calyx* globoso-campanulatus, vix lin. longus, strigoso-hirsutus, pilis capitato-incrassatis, dentibus brevissime triangularibus. *Petala* oblonga, appendiculo setiformi caudata, minuta. *Stamina* aequalia, filamentis in parte tertia superiore subgeniculatis, antheris obtusis, dorso inappendiculatis. *Ovarium* squamis obtusis vel crenulatis coronatum. *Capsula* globosa, $\frac{3}{4}$ lin. lata.

**Dizygotheca,*** *N. E. Brown.* [Araliacearum Genus novum] Calycis margo 5-dentatus. Petala 5, valvata. Stamina 5, filamentis crassiusculis; antheræ oblongæ, quadriloculares! Ovarium 10-loculare; styli 10, distincti, imprimis papilliformes, post antheras delapsas elongati. Fructus subglobosus vel ellipsoideus, baccatus; pyrenæ a latere compressæ, induratæ. Semen a latere compressum, albumine æquabili. Arbor parva. Folia digitatim composita. Umbella magna, composita, terminalis; bracteæ membranaceæ, caducæ. Flores hermaphroditi.

25. **Dizygotheca Nilssoni,** *N. E. Brown.* Glabra; caule simplici inermi, foliis digitatis, petiolis elongatis basi valde intumescentibus, foliolis 9–11 coriaceis longe petiolulatis elongato-oblongis, apice retusis vel emarginatis, basi plus minusve acutis, integris parum sinuatis subundulatis, umbellæ ramis primariis septem, medio quadriradiato apice decemradiato, umbellulis longe pedunculatis, floribus pedicellatis, petalis viridi-luteis, antheris albidis, baccis atroviolaceis.

*Aralia Nilssoni*, Linden Catalogue 1880, p. 54, name only.

*Caulis* 7–10 pedalis. *Petioli* 18–20 poll. longi; petioluli 2–3 poll. longi; foliola 9–13 poll. longa, 2–$3\frac{1}{2}$ poll. lata. *Umbella* circa 18–20 poll. diam., ramis primariis $8\frac{1}{2}$ poll. longis; *pedunculi* 2–3 poll. longi; pedicelli $\frac{1}{2}$ poll. longi. *Flores* $\frac{5}{8}$ poll. diam. *Baccæ* $\frac{3}{8}$ poll. diam.

This fine Araliad was received at Kew from Mr. Linden in 1880, and flowered for the first time in November 1891. Its native country is not stated, but very probably it came from one of the Pacific Islands. It is remarkable on account of its four-celled anthers, which character combined with its ten-celled ovary at once distinguish it from all other members of the order, of which the flowers are properly described.

26. **Trichocline (Ingenhousia) cordifolia**, *Baker* [Compositæ Mutisiaceæ]; perennis, acaulis, petiolis elongatis albo-tomentosis, foliis subcoriaceis cordato-ovatis denticulatis facie viridibus glabris nitidis dorso persistenter albo-tomentosis, pedunculo longissimo, capitulo semigloboso solitario, involucri bracteis pauciseriatis imbricatis adpressis valde inæqualibus dorso alboaraneosis, pappi setis perplurimis albidis ciliatis, ligulis parvis.

Rio Janeiro, *Glaziou* 17104, 18320.

*Petioli* pedales et ultra. *Folia* semipedalia. *Pedunculus* bipedalis et ultra. *Involucrum* 5–6 lin. longum. *Pappus* 3 lin. longus.

A very distinct species, nearest *T. Martii*, Baker in Fl. Bras. Vol. VI. pt. iii, p. 675.

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* δίζυξ double, θήκη, a receptacle, in allusion to the anthers having double the usual numbers of cells.

27. **Trichocline (Ingenhousia) paraguayensis**, *Baker* [Compositæ Mutisiaceæ]; perennis, acaulis, foliis rosulatis oblanceolatis subacutis integris subcoriaceis in petiolum brevem sensim attenuatis facie viridibus glabris dorso persistenter albo-incanis, pedunculo stricto longissimo albo-tomentoso, capitulo magno solitario semigloboso, involucri bracteis pauciseriatis adpressis valde inæqualibus dorso albo-tomentosis intimis linearibus, pappo albo flexuoso, ligulis luteis magnitudine mediocribus.

Paraguay: sandy soil near Valenzia, *Balansa* 4693.

*Folia* 6–8 poll. longa, supra medium 15–18 lin. lata. *Pedunculus* 1–2 pedalis. *Involucrum* 6–7 lin. longum. *Pappus* 5–6 lin. longus. *Ligulæ* 3–4 lin. longæ.

Near *T. speciosa*, Less., D.C. Prod. VII. 20, from which it differs by its larger leaves, narrower involucral bracts and smaller ligules.

28. **Vitex (Chrysomallum) hirsutissima**, *Baker* [Verbenaceæ]; fruticosa, caule recto simplici gracili, foliis digitatim 5-foliolatis ad caulis apicem aggregatis petiolatis, foliolis magnis oblongis subsessilibus subcoriaceis utrinque breviter pubescentibus, apice obtusis emarginatis basi cuneatis, cymis compositis densis sessilibus axillaribus, ramulis, pedicellis calycibusque dense hirsutis, bracteis linearibus, calycis tubo campanulato dentibus angustis tubo subæquilongis, corollæ tubo infundibulari limbo bilabiato, genitalibus conspicue exsertis.

North Madagascar, *Baron* 6585.

*Foliolum* centrale 10–12 poll. longum, 6–7 lin. latum. *Calyx* 4 in. longus. *Corolla* 9–10 lin. longus.

A very striking plant, from its habit, very large horse-chestnut-like leaves and densely hairy flowers. In structure it is nearly allied to *V. Chrysomallum*, Steud.; Schauer in D.C. Prod. XI. 694 (*Chrysomallum madagascariense*, Petit Thouars).

29. **Æchmea (Hohenbergia) microthyrsa**, *Baker* [Bromeliaceæ]; acaulis, foliis longissimis ensiformibus ad apicem sensim angustatis utrinque lepidotis, basi dilalato oblongo, spinis marginalibus parvis castaneis, pedunculo elongato foliis pluribus lanceolatis magnis prædito, floribus in paniculam parvam densam aggregatis, ramis racemosis, pedicellis erecto-patentibus flore brevioribus, ovario oblongo parvo nudo, sepalis coriaceis oblongo-lanceolatis conspicue mucronatis, petalis parvis.

Rio Janeiro, *Glaziou* 18564.

*Folia* 3–4 pedalia, medio 1 poll. lata, basi dilatato oblongo 4–5 poll. longo. *Pedunculus* validus, bipedalis. *Panicula* 3–4 pollicaris, pedicellis circiter 3 lin. longis. *Sepala* 6 lin. longa.

Allied to *Æ. floribunda* Mart. (*Æ. organensis*, Wawra Itin. Prin. Sax., Cob., 146, tab. 23), from which it is easily recognised by its larger pedicellate flowers.

30. **Streptocalyx orthopoda**, *Baker* [Bromeliaceæ]; acaulis, foliis loratis subcoriaceis basi valde dilatatis obscure lepidotis apice rotundatis cuspidatis, spinis marginalibus corneis nigro-castaneis inferioribus crebris magnis superioribus sensim minoribus sparsioribus, floribus in paniculam amplam thyrsoideam dispositis ramis corymbosis, bracteis primariis parvis lanceolatis, pedicellis elongatis strictis, ovario oblongo nudo, sepalis coriaceis oblongo-lanceolatis mucronatis ovario longioribus, petalis parvis angustis.

Rio Janeiro, *Glaziou* 18565.

*Folia* bipedalia medio 12–14 lin. lata, basi dilatato oblongo 6–7 poll. longo, 4 poll. lato. *Panicula* pedalis, pedicellis inferioribus $1\frac{1}{2}$–2 poll. longis. *Calyx* (ovario infero incluso) 10 lin. longus.

Near *S. podantha*, Baker Handb., Brom. p. 32, another discovery of Dr. Glaziou's, from which it may easily be recognised by its broad thyrsoid panicle with corymbose branches, long erecto-patent pedicels, and oblongo-lanceolate sepals longer than the ovary.

## CCLXII.—LAGOS PALM OIL.

(*Elæis guineensis*, Jacq.)

In the *Kew Bulletin*, 1891, p. 190, an account was given of the palm oil industry on the West Coast of Africa taken from the report of a Commission appointed in 1887 to consider the promotion of economic agriculture on the Gold Coast. As showing the importance and value of the palm oil as an article of commerce, the following note is taken from the *Journal of the Society of Arts* for March last, p. 407 :—

"The total import of palm oil into England is about 50,000 tons, valued at over 1,000,000*l.*, but it is considered that this is an exceedingly small commerce compared to what might be the case were the enormous resources fully, or even moderately, utilised. For miles along the West Coast of Africa, extending between Cape Bianco and St. Paul di Loanda, there are vast forests of palms, the oleaginous fruit of which has, for centuries, rotted unused upon the ground. The oil palm forests at the back of the coast line of Cape Palmas and Elmina are said to be practically inexhaustible; and so also in the neighbourhood of Fernando Po, immense tracts are covered with the trees.

"Lagos furnishes the purest oil: for there are in commerce regular and irregular oils. When analysed, if the water and impurities exceed 2 per cent., an allowance is made; for often these oils contain 10 to 15 per cent. of water and impurities.

"Palm oil is eaten as butter by the natives, and used for anointing their bodies. Here it is used in the manufacture of soap and candles, and in South Wales in the preparation of tin plates. Its non-drying qualities render it valuable as a preservative of the surface of the heated iron sheet from oxidation until the moment of dipping into the bath of melted tin, the sheets being rapidly transferred to that from the hot oil bath, which consists almost entirely of palm oil.

"In 1871, as well as in 1880 and 1891, the imports of palm oil into the United Kingdom exceeded 1,000,000 hundredweight. From 10,000 to 15,000 tons of palm oil are shipped direct from Africa to the Continent. The price of the oil has ranged from 35*s.* per cwt., in 1883, to 23*s.* in 1890."

Reference is made in the above extract to the superior quality of Lagos palm oil. This fact was especially dwelt upon in the report of the Gold Coast Commission above mentioned, and a desire was expressed to obtain particulars of the method for preparing the oil in use in the former Colony. The same desire is expressed in the following letter addressed to Kew. The palm oil prepared in West Africa is extracted from the pericarp of the fruits. There is, however, another oil extracted from the kernels of the nuts. Usually these kernels are obtained by cracking the nuts by hand and shipping them to Europe, where the oil is usually expressed. The following letter refers in the first place to a useful machine that has been introduced to West Africa for extracting the kernels in an expeditious manner, and in the second place it asks for information respecting the special preparation of Lagos palm oil.

MR. G. A. MOORE to ROYAL GARDENS, KEW.

42, Tower Buildings, Liverpool,
2nd September 1891.

DEAR SIR,

MY attention has only just been called to an extract from the *Kew Gardens Bulletin* which was published in the *Liverpool Journal of Commerce* on the 21st ultimo, relating to the preparation of palm oil.

If you will read the enclosed prospectus it will give you some information about a machine [for extracting the kernels of palm nuts],

African Oil Palm.
(*Elæis guineensis*, Jacq.)

which I have now had in almost continuous operation in Brass River since 1878, and which does its work in the most satisfactory manner, provided the nuts are brought to it dry. The labour in connexion with it is only that necessary to bring the nuts to the feed, and carry away the shell and kernel when cracked. The latter are separated at once by taking advantage of their different specific gravities, which causes the kernel to float and shell to sink when dropped into brine of a certain density. Before shipment we winnow the kernels to get rid of any of the external coat or fibre which may get through the machine and float with the kernels in the bath, and also to dry them thoroughly.

There would appear to be nothing to prevent a large and growing business to be done with these machines in the Oil Rivers, as there the difficulty of carriage does not obtain, the country being canalised by nature to an extent unknown until a short time ago, even to the oldest traders.

* * * * *

I should be glad if you could give me any particulars of the "cold" process [for extracting palm oil] referred to as being in use at Lagos.

Yours, &c.
(Signed) G. A. Moore.

P.S.—One more remark I would like to add, viz., there would be no pecuniary gain in crushing kernels on the coast instead of here and on the Continent.

D. Morris, Esq., G. A. M.
Royal Gardens, Kew.

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Royal Gardens, Kew, to Colonial Office.

Royal Gardens, Kew,
4th September 1891.

Sir,

I am desired by Mr. Thiselton-Dyer to inform you that an extract respecting the African oil palm (*Elæis guineensis*), taken from the report of the Commission appointed in 1887 to consider the promotion of economic agriculture on the Gold Coast, has appeared in the July number of the *Kew Bulletin* [1891, p. 190].

2. Attention is drawn in this extract to the superior quality of palm oil from Lagos, which is described as the purest known. It is mentioned that this superior quality may, in some measure, be due to the "cold" process of manufacture pursued at Lagos as opposed to the "hot" process pursued at the Gold Coast and other places.

3. The prominence given to the subject in the pages of the *Kew Bulletin* has led to inquiry being made at this establishment for details of the "cold" process pursued at Lagos for extracting palm oil. It is evident that such details would be of general value to people in this country interested in West African industries as well as to people in other parts of West Africa.

4. Under these circumstances Mr. Thiselton-Dyer would venture to suggest that an application be made to the Government of Lagos for an account of the palm oil industry as pursued in that Colony and especially in regard to the special process or processes there employed for extracting oil from the pericarp of the palm nuts.

5. On receipt of the information now desired Mr. Thiselton-Dyer would be glad to arrange for a summary of it to appear in the *Kew Bulletin*.

* * * * *

I have, &c.
(Signed) D. Morris.

The Hon. R. H. Meade, C.B.,
Colonial Office.

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### Colonial Office to Royal Gardens, Kew.

Sir, Downing Street, 16th January 1892.

I am directed by the Secretary of State for the Colonies to transmit to you, for your information, with reference to your letter of the 4th of September last, a copy of a despatch from the Governor of Lagos, enclosing a report upon the preparation of palm oil, with five photographs, and also a report upon the extraction of fibre from the leaf of the oil palm.

I am, &c.

The Director, (Signed) Robert G. W. Herbert.
Royal Gardens, Kew.

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### His Excellency G. T. Carter to Colonial Office.

My Lord, Government House, Lagos, November 23rd, 1891.

In reply to your Lordship's despatch, No. 183, of the 10th September, covering a communication from the authorities at Kew, asking for information in regard to the preparation of the palm oil as exported from Lagos, and also as to the extraction of fibre from the leaf of the oil palm,* I have the honour to inform your Lordship that I placed the matter without delay in the hands of Mr. Millson, the Assistant Colonial Secretary, who has taken much trouble to carry out my wishes.

2. I enclose herewith two reports from that officer giving clear details as to both processes which I trust will be useful.

3. The photographs which so well illustrate the process of separating the oil from the fibrous nut, were taken by Mr. Haddon Smith to whom the thanks of the Government are especially due. . . . . .

I have, &c.

The Right Hon. Lord Knutsford, (Signed) G. T. Carter,
&c. &c. &c. Governor.

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### Notes on the preparation of Lagos Palm Oil.

The chief flowering season of the Oil Palm (*Elæsis guineensis*), (Yoruba name Igi okpwe) in the neighbourhood of Lagos is during the September and October rains, the second and lesser rainy season of the year. The fruit takes from four to five months to develop, the main-crop coinciding with the Harmattan or desert wind, which blows in the months of December and January from the Sahara to the sea.

This dry and cold wind is supposed by the natives to assist in ripening the fruit, and they have a saying that a strong Harmattan brings plenty of palm oil. Experience, however, tends to show that heavy rains during the flowering season have a more decided influence upon the crop.

During the months of February, March, April, and May the palm trees are in full bearing and the main crop of the year is gathered. The waterways are then busy with flotillas of trading canoes, the lagoon

* Oil palm fibre is discussed is the *Kew Bulletin* for March 1892, p. 62, with woodcuts.

Preparation of Lagos Palm Oil. (Boiling Process.)

sides gleam with fires and the hoarse songs and shouts of the natives at work are heard throughout the night.

The trees continue to bear small quantities of fruit during the remaining months of the year, but the amount of palm oil produced for shipment is comparatively small.

In order to gather the fruit the trees are climbed with the help of two stout ropes which are passed round the stem and serve as a support to the worker. By one of these the tree and the waist of the climber are loosely encircled, leaving the body room for considerable freedom of movement. At both ends of the other rope are loops, through the larger of which the left leg is passed to the thigh, while the right foot rests in the smaller loop. This rope is somewhat shorter in proportion than the body rope. By this means a sort of cradle is formed in which the climber rests by the weight of his reclining body and the pressure of his feet against the stem. The waist rope is held in the hands and jerked upwards against the tree. The body is then thrown backwards so as to put a full strain upon this upper rope, while the feet are planted firmly against the tree and worked alternately upwards, carrying the lower rope with them.

In this way a man can walk up a palm tree with great rapidity and ease, and on arriving at the top can move both hands freely, while leaning back comfortably on his ropes. The rough, scaly excrescences on the stem of the Oil Palm [bases of old leaves] keep them from slipping down though they offer no resistance to their upward movement.

The "hands" of fruit (Yoruba, Idi okpwe) are cut with a small native hatchet, with a narrow triangular blade, and are trimmed and cleaned with a cutlass.

They are then put in a heap and are covered with a thin layer of palm leaves, and left to stand for a period varying from four to ten days until fermentation sets in. Care is taken that this process (called in Yoruba "On she basha") should not continue for too long. As soon as the nuts become loose in their sockets they are removed by hand, and put into baskets. In order to be able to pick them out more easily the "heads" are cut into small pieces with a cutlass.

A hole is then dug with a channel leading to it, and a large earthenware pot holding about 11 gallons is placed upon bricks which are balanced on the edge of the hole. By this means a thorough draught and an equal distribution of heat is secured.

*Boiling process* (Yoruba—On se engiu).—The bottom of the pot is plastered to an inch and a half in thickness with a mixture of wood, ashes, and water, the object being to secure a steady heat, which could not otherwise be obtained with irregular firing.

Five or six double handfuls of dried palm kernel shells are then thrown into the hole, fire is made with the dried refuse of the pericarp of the nuts, and logs of wood about the thickness of a man's wrist are used as fuel.

About 56 pounds of palm nuts (Yoruba for palm nut, Enyin) are put in the pot and covered with water. They are then boiled for an hour and a half or two hours, until the pericarp is soft enough to be squeezed easily between the fingers. A little water is added from time to time during the boiling process in order to keep the nuts covered. No oil exudes during this process.

*Mashing process* (Yoruba—On te enyin).—When considered to be sufficiently softened, the nuts are strained in baskets, and put into a canoe which has been hauled up out of the water for the purpose. They are then trodden with the bare feet by natives who support themselves on

two sticks as they stamp heavily backwards and forwards in the canoe, pressing with a peculiar twisting motion of the feet so as to strip the pericarp from the kernels. The feet are carefully washed both before and after the treading process.

In this manner it takes 45 minutes for three men to tread two hundredweight of nuts.

*Washing process* (Yoruba—On she epol'owo).—Cold water is then poured into the canoe to a depth of 3 or 4 inches above the pounded mass, a portion of the canoe about a third of its length being dammed off for this purpose by the material in process of being washed.

The fibre of the bruised pericarp is stirred up in the water with the hands, grasped in handfuls, separated from the kernels, shaken to and fro with a switching motion in the water, thoroughly squeezed and thrown aside into baskets.

While this is going on the water is ladled up and poured rapidly from a height out of calabashes back into the canoe. The remaining fibre is separated from the kernels and sieved out by sidelong blows of a small basket. Neither the fibre nor the kernels float on the surface.

After a short time the water in the canoe becomes covered with a thick gamboge-coloured scum, which is driven together by agitating the surface of the water with the fingers, and is skimmed off with the double hands into a floating calabash. This scum contains the oily particles which have been set free from the bruised pericarp. It is of the consistency of thick cream, and is full of minute air bubbles. As the water in the canoe gets muddy, with a peculiar dirty greenish tinge, it is thrown out and fresh water is added.

This process is repeated until the whole of the material has been thoroughly washed. The fibre is then placed in a mortar and beaten, and afterwards washed again, after which it is pressed into balls with the hands and put in the sun to dry.

Of this dried fibre I forward a specimen which may possibly prove of some value at home. The only use for it here is as tinder and in making fires.

The kernels are placed in baskets, and afterwards dried in the sun and cracked between stones for export as "palm-kernels," over 37,000 tons of which are annually shipped from Lagos. The kernel shells are used for firing and are made into blacksmiths' charcoal.

The oil is now ladled out of the pot into which it has been skimmed, and is placed in another pot on the fire. About one-eighth of its bulk of water remains in the pot in which it has been standing.

*Clarifying process* (Yoruba—On se epo). While the crude oil is being clarified by boiling it is carefully sieved by passing a small basket through it so as to remove all fragments of fibre. By this means also it is kept well stirred. Considerable care has to be used in regulating the fire so as to avoid excessive heat. After boiling for about half an hour the oil is seen to turn almost blood-red, while the water upon which it floats is of a yellowish green colour.

The oil is now carefully skimmed off, and strained through a small basket into an earthenware pot. After standing in this for a few minutes it is again skimmed with a small calabash into a five-gallon jar in which it will eventually be sent to market. As the water begins to show in the lower portion of the oil, it is submitted to a further process of boiling, and is skimmed again.

The whole process of palm-oil making, from the boiling of the nuts to the final skimming of the oil takes from 8 to 14 hours, according to the quantity dealt with and the number of persons employed.

Preparation of Lagos Palm Oil. (Washing Process.)

It is usual to begin work at about 4 o'clock in the afternoon and to work all night, washing and skimming the oil in the cool of the morning.

From careful experiments carried out under my supervision I find that two hundredweights of palm nuts give exactly two imperial gallons of oil, or an average of a gallon a hundredweight.

As an average yield of an hundredweight to five trees is considered a fair crop, counting male and barren trees, it would appear that to produce the 3,000,000 gallons of palm oil annually exported from Lagos, no less than 150,000 tons of palm nuts are each year gathered from 15,000,000 trees.

Every stage in the manufacture of Lagos oil is marked by great care and cleanliness, and the result is a remarkably pure sample of oil.

(Signed) ALVAN MILLSON,
Assistant Colonial Secretary.

## CCLXIII.—NEW ORCHIDS: DECADE 3.

21. **Pleurothallis stenosepala**, *Rolfe, n. sp.*—Caules graciles, circa 5–6 poll. longi. Folia cordato-oblonga, acuminata, 3 poll. longa, $1\frac{1}{4}$ poll. lata. Flores sæpissime solitarii, axillares. Sepalum posticum patens, subulato-lineare, attenuatum, 10–11 lin. longum, $1\frac{1}{2}$ lin. latum, dorso carinatum. Sepala lateralia omnino connata, basi $2\frac{1}{2}$ lin. lata, cæteris sepalo postico similia. Petala patentia, subulata, 2 lin. longa. Labellum cordato-oblongum, subobtusum, carnosum, muriculatum, subtus infra apicem minute tuberculatum. Columna brevissima.

A species belonging to Lindley's group *Macrophyllæ fasciculatæ*, and allied to *P. Cardium*, Rchb. f., but differing in its much longer and narrower sepals, which, as well as the petals, are light green in colour. The lip is of a light brownish-buff shade. It has flowered in the Kew collection on several occasions, and has recently been sent for determination by R. J. Measures, Esq., Cambridge Lodge, Flodden Road, Camberwell.

22. **Lepanthes gracilis**, *Rolfe, n. sp.*—Caules graciles, angulati, hispiduli, $1\frac{1}{2}$–$2\frac{1}{2}$ poll. longi; vaginarum limbus ovatus, mucronatus, denticulatus. Folia elliptica, mucronata, $\frac{3}{4}$–$1\frac{3}{4}$ poll. longa, 5–8 lin. lata. Racemi foliis breviores, 1–$1\frac{1}{4}$ poll. longi, distichi. Bracteæ conduplicatæ, late triangulo-ovatæ, acutæ, $\frac{3}{4}$ lin. longæ. Pedicelli medio articulati, $1\frac{1}{2}$ lin. longi. Flores $2\frac{1}{2}$–3 lin. longi. Sepala ovata, acuta, $1\frac{1}{2}$ lin. longa, lateralia semilibera. Petala obliqua, oblonga, obtusa, basi in auriculam lineari-oblongam laminam fere æquantem extensa, 1 lin. longa. Labelli unguis columnæ adnata, limbus hippocrepiformis, apice acute bilobus, lobi laterales reflexi, acuti. Columna brevissima.

This little species has recently flowered in the Kew collection, but nothing is known of its origin. It belongs to the section *Distichæ*, and is allied to *L. concinna*, Sw., which, however, is a considerably larger plant. The present species has bright yellow sepals, deep yellow petals, usually with a maroon-purple border on the inner side, a yellow lip, and dull purple column.

23. **Restrepia dentata**, *Rolfe, n. sp.*—Planta cæspitosa, parva, caulibus brevibus. Folia ovato-oblonga, obtusa, minute tridenticulata, carnosa,

circa $1\frac{1}{4}$ poll. longa, $\frac{3}{4}$ poll. lata. Pedicelli graciles, $1\frac{1}{2}$ poll. longi. Bractea $1\frac{1}{2}$ poll. longa, carinata. Sepalum posticum $6\frac{1}{2}$ lin. longum, infra medium concavum, lanceolato-lineare, dein aciculare, apice crasso-clavatum. Sepala lateralia semiconnata, 6 lin. longa, linearia, obtusa. Petala 4 lin. longa, infra medium lanceolata, dein acicularia, apice crasso-clavata, supra basin utrinque unidentata. Labellum 2 lin. longum, pandurato-oblongum, truncatum, supra medium muriculatum, supra basin utrinque falcato-setaceum. Columna clavata, incurva, $1\frac{1}{2}$ lin. longa.

A very distinct little species which has flowered in the Glasnevin Botanic Garden on several occasions, and been sent to Kew for determination. It has a very marked peculiarity in the presence of a pair of slender, stipule-like teeth on the petals, one on either side, about the middle of the lanceolate basal portion, and these are decurrent below their free apex. The dorsal sepal and petals are semi-transparent white, with three purple lines, the decurrent teeth of the latter being yellow. The lateral sepals are dull yellow, nerved with brownish purple below, and the lip brownish purple with the falcate side lobes deep yellow. Mr. Moore is unable to state its native country, though in all probability it comes from some part of the Andes.

24. **Cœlogyne flexuosa**, *Rolfe*, *n. sp.*—Pseudobulbi approximati, conico-ovoidei, subtetragoni, $2\frac{1}{4}$–$2\frac{1}{2}$ poll. longi, 1 poll. lati, diphylli. Folia oblanceolata, acuta, basi attenuata, 8–11 poll. longa, $1\frac{1}{4}$–$1\frac{3}{4}$ poll. lata. Scapus terminalis, gracilis, foliis æqualis, racemo circa 13-floro flexuoso, floribus distichis. Bracteæ deciduæ, oblongo-lanceolatæ, acutæ, $\frac{3}{4}$–$1\frac{1}{4}$ poll. longæ. Pedicelli graciles, $\frac{1}{2}$–$\frac{3}{4}$ poll. longi. Ovarium acute hexangulatum v. fere hexapterum. Sepalum ovato-oblongum, subobtusum, acute carinatum, 7 lin. longum, 3–$3\frac{1}{2}$ lin. latum. Petala linearia, subobtusa, $1\frac{1}{4}$ lin. lata. Labellum trilobum, basi transversim angustissime constrictum, lobis lateralibus erectis apice rotundatis, lobo medio elliptico-oblongo obtuso, disco tricarinato, carinis vix undulatis. Columna clavata, angulis anguste marginatis.

The present species is a member of Lindley's group *Flexuosæ*, and is allied to *C. simplex*, Lindl. and *C. suaveolens*, Hook. f. From the former, however, it is readily distinguished by its sharply hexangular ovary, broader petals, and the more slender keels of the lip; from the latter by the narrower petals and the straight, not very undulate, keels of the lip; and from both by its habit of producing the scapes from the summit of the nearly mature pseudobulbs between the leaves, not from the young growths. It is a native of Java, and was presented by the Botanic Garden at Leyden to the Kew collection, where it flowered in April of the present year. It was also received from Mr. F. W. Moore, Glasnevin Botanic Garden, Dublin, as a Javan species, as long ago as May 1889, when it could not be determined. The flowers are white with a light yellow stain across the middle of the lip, which is extended as a narrow line on either side of the disc to near the base, at which point the lip is very sharply constricted, producing a narrow transverse channel underneath.

25. **Epidendrum bituberculatum**, *Rolfe*, *n. sp.*—Caules erecti, graciles. Folia linearia, subobtusa, $2\frac{1}{2}$–3 poll. longa, 3–4 lin. lata. Racemus corymbosus, demum elongatus. Bracteæ ovatæ v. ovato-lanceolatæ, acutæ, $\frac{1}{2}$–$1\frac{1}{2}$ lin. longæ. Pedicelli 9 lin. longi. Sepala late lanceolata, acuta, $3\frac{1}{2}$ lin. longa; lateralia subobliqua. Petala paullo angustiora. Labellum trilobum, fimbriatum, lobis lateralibus rotun-

datis, lobo medio bilobo, disco carinato basi bicalloso. Columna clavata.

This species belongs to Lindley's group *Schistochila carinata*, and is allied to *E. Schomburgkii*, Lindl., though a smaller and more slender plant, with smaller rosy-purple flowers, resembling *E. elongatum*, Jacq., in colour. The calli at the base of the lip are yellow. It was sent to Kew for determination by Sir Trevor Lawrence, Bart., M.P., of Burford Lodge, Dorking, in February 1890, and again during the present year. Its habitat is not recorded.

26. **Maxillaria glumacea**, *Rolfe, n. sp.*—Pseudobulbi oblongi, compressi, ancipites, 4 poll. longi, 1½ poll. lati, monophylli. Folia elongato-linearia, 1½ ped. longa, 1½ poll. lata. Scapi erecti, 4 poll. longi, vaginis imbricatis tecti. Bracteæ convolutæ, acutæ, 1¼ poll. longæ. Sepala glumacea, oblongo-lanceolata, concava, apice acutissima, rigida, 1¼ poll. longa. Petala linearia, acuta, 1 poll. longa, 1¼ lin. lata. Labellum obscure trilobum, 8 lin. longum, 3½ lin. latum, lobis lateralibus angustis, lobo medio triangulato-lanceolato acuto apice rigido incurvo, callo lineari carnoso nitido. Columna clavata, 5 lin. longa.

A species allied to *Maxillaria aciantha*, Rchb. f., and *M. coriacea*, Rodr., recently introduced from Brazil by Messrs. F. Sander & Co., of St. Albans, with whom it flowered in June of the present year. The glume-like very acute and rigid sepals are of a dull yellowish-green, as are also the petals. The lip has dull maroon-purple side lobes, while the front lobe is deep blackish-brown, with yellow margin and apex, and the fleshy linear callus of a shining purple-brown. The short scapes are clothed with about four or five loose imbricating sheaths.

27. **Aspasia Barclayi**, *Rolfe, n. sp.*—Pseudobulbi elliptico-oblongi, subcompressi, ancipites, 1½ poll. longi, ¾ poll. lati. Folia oblongo-linearia, acuta, 6 poll. longa, 7–9 lin. lata, pallide viridia. Racemi breves, pauciflori. Bracteæ ovatæ, acutæ, 2 lin. longæ. Pedicelli 9–12 lin. longi. Sepala patentia, elliptico-oblonga, subacuta, basi subattenuata, 8–9 lin. longa. Petala sepalis similia. Labellum sessile, late pandurato-oblongum, emarginatum, 8 lin. longum, prope basin 7 lin. latum, prope apicem paullo angustius, disco bicarinato. Columna clavata, 8 lin. lata.

A small species sent to Kew for determination by W. L. Barclay, Esq., The Briars, Reigate, in July 1891. It is allied to *A. Principissa*, Rchb. f., and *A. psittacina*, Rchb. f., though its flowers are much smaller, and otherwise different. The sepals and petals are of a very pale yellowish-green, with broad transverse light olive-green bands, and the lip white, with some nearly confluent light purple markings in front of and beside the keels, and a pair of small yellow markings at the extreme base. In addition to the two central keels there are three or four obscure radiating ones on either side at the extreme base of the lip. Its habitat is not recorded.

28. **Oncidium cristatum**, *Rolfe, n. sp.*—Pseudobulbi ovoidei v. ovoideo-oblongi, subcompressi, 2–3 poll. longi, 1¼–1¾ poll. lati. Folia lineari-lanceolata, acuta, 4–6 poll. longa, ¾–1 poll. lata. Scapi 4 ped. alti, scandentes v. subvolubiles, apice ramosi, ramis laxifloris. Bracteæ ovato-lanceolatæ, acutæ, 1½ lin. longæ. Sepala reflexa, unguiculata, lineari-oblonga, obtusa, undulata, lateralia 8 lin. longa, posticum paullo breviora. Petala reflexa, breviter unguiculata, oblonga, obtusa, undulata, 6 lin. longa. Labellum pandurato-trilobum, lobo medio amplo orbiculari-reniformi retuso 6–8 lin. lato, lobis lateralibus parvis orbiculari-oblongis

1 lin. latis, crista quinquilamellata lamellis crenulato-cristatis. Columna brevis, alis falcato-oblongis obtusis crenulatis fere 2 lin. longis.

A distinct and pretty species introduced from Brazil by Messrs. Linden, L'Horticulture Internationale, Brussels, which flowered in April of the present year, and was sent to Kew for determination. It is allied to *O. schillerianum*, Rchb. f., and *O. Volvox*, Rchb. f., with which it agrees in its somewhat twining scape. The sepals and petals are reflexed, undulate, and of a clear bright yellow, the lip a little deeper yellow with a row of suffused red-brown dots on either side of the crest, and the column-wings deep yellow. The crest consists of five parallel cristate-crenulate keels, the two outer ones being longer, and the two next considerably shorter than the middle one.

29. **Crypripedium pusillum**, *Rolfe, n. sp.*—Caules nani, pubescentes, diphylli. Folia opposita, late elliptico-oblonga, obtusa, membranacea, puberula, 2–2¾ poll. longa, 1¼–1¾ poll. lata. Flores terminales, parvi, in racemum abbreviatum corymbiformem pauciflorum dispositi. Bracteæ lanceolatæ, acutæ, glabræ, 5–8 lin. longæ. Ovarium glanduloso-pubescens, 4–5 lin. longum. Sepala subpatentia, ovato-lanceolata, acuta, 6–7 lin. longa, lateralia fere omnino connata. Petala sepalis similia. Labellum parvum, 4 lin. longum, oblongo-globosum, ore semicirculare. Columna brevis, staminodio trulliformi-ovato, stigmate ovato.

This is a curious little species, closely allied to *Cypripedium fasciculatum*, Kellogg, a native of California and Oregon, being in fact the only other member of the section *Diphyllæ* with racemose flowers. The present species, however, is a much smaller plant in every respect, barely exceeding 4 inches high. The flowers are light yellow, longitudinally veined with dull brownish-purple, with a light yellow lip; they become more purple as they fade. The infolded margin of the lip, which is strongly infolded round the mouth, is at the base suddenly turned out and reflexed. A plant was purchased for the Kew collection in May last, without any record of its origin, but shortly afterwards it was sent for determination by H. J. Elwes, Esq., of Cirencester, who had received it with the information that it came from Florida. It has also flowered with Messrs. F. Sander & Co., of St. Albans.

30. **Cypripedium Henryi**, *Rolfe, n. sp.*—Planta circa 2 ped. alta. Caules pubescentes, foliosi. Folia elliptico-oblonga v. late elliptica, acuminata, plicata, 4–8 poll. longa, 1–4 poll lata. Racemi 2–4 flori. Bracteæ ovato-lanceolatæ, acuminatæ, 1½–2 poll. longæ. Ovarium dense glanduloso-pubescens. Sepalum posticum lanceolato-ovatum, acuminatissimum, 1½ poll. longum, ½ poll. latum. Sepala lateralia fere omnino connata, apice bifida, sepalo postico æqualia. Petala lineari-lanceolata, acuminatissima, sepalis paullo longiora. Labellum inflato-calceolatum, ¾ poll. longum. Staminodium late obovato-oblongum, subacutum.

China: Prov. Hupeh and Szechuen; Dr. Aug. Henry, n. 5391.

A very distinct species of the section *Foliosæ*, allied to the Himalayan *C. cordigerum*, Don, but with flowers in racemes and many other differences. The colour of the flowers has not been recorded, but judging from what can be seen in the dried state may be greenish-yellow, with a somewhat paler lip.

## CCLXV.—SOME VANILLAS OF COMMERCE.

In the *Kew Bulletin* 1888, p. 76, an account was given, with a plate, of the Vanilla plant. It was pointed out that, with the exception of Mauritius and the Seychelles, a vanilla industry had not assumed an important position in any British colony. Since 1888, however, a very successful attempt has been made to start a vanilla industry in the Fiji Islands. Samples of Fiji Vanilla were received in this country last year, and they were very favourably received. As indicating the importance of the world's production of Vanilla, the following paper, prepared by Dr. Beringer and published in the *America Journal of Pharmacy*, is reproduced from the *Pharmaceutical Journal*, July 2, 1892:—

While the home of the vanilla is Mexico and South America, its cultivation, originally greatly encouraged by the French Government, has been extended by individual enterprise, till now the plant is cultivated in numerous and widely distributed countries; as, for instance, the West Indies and some of the islands of the Indian and Pacific oceans, the essentials being a mean temperature of 75° to 80°, and sufficient moisture, at least during certain seasons of growth. In a circular issued in 1890, Mr. Hires described the vanilla plant as a *parasite*, stating that "it takes its life and sustenance from the Mexican red "cedar, which abounds in that country." This error is being repeated, and singularly such an authority as the *Encyclopædia Britannica* states "the plant has a long, fleshy stem, and attaches itself by its aërial root-"lets to trees, and appears to be little dependent upon the soil for its "nourishment." While epiphyte in its character, clinging to forest trees for support, it is not parasitic, obtaining its support principally through its aërial roots, which drop to the ground, and in many of the cultivations in the islands of the Indian Ocean the plants are supported for a considerable length upon rude trellises.

The products of the Java vanilla cultivators are exported to Holland and do not reach this country. The varieties entering our markets being the Mexican, Bourbon, Seychelles, Mauritius, Tahiti, South American, and Vanillons, with occasionally a few pounds of unknown origin brought in by trading vessels. The products of Mauritius and the Seychelles are usually shipped to London; while those from the French possessions, Réunion, Tahiti, Mayotte, &c., go to France.

U. S. Consul Horace G. Knowles, of Bordeaux, reports (*see* U. S. Consular Reports, September 1891, 127, as follows:—"Paris, London, "and New York are the markets of the world for vanilla. The greater "portion imported into France comes from her colonies, Guadaloupe, "Madagascar (Saint Marie), Mayotte, Réunion, and Tahiti. Just "what the products have been may be judged from the following "table:—

| — | Réunion. | Guadaloupe. | Mayotte. | Sainte Marie. | Tahiti. |
|---|---|---|---|---|---|
| | lbs. | lbs. | lbs. | lbs. | lbs. |
| 1880 | 164,289 | — | — | — | — |
| 1885 | 155,548 | 9,532 | 2,640 | 8,800 | 18,350 |
| 1886 | 361,587 | 12,100 | 4,774 | 18,260 | 5,500 |
| 1887 | 417,230 | 6,820 | 2,596 | 16,610 | 6,600 |
| 1888 | 462,660 | 9,044 | 19,195 | 19,195 | 6,490 |
| 1889 | 506,462 | — | — | — | 7,018 |

*Mexican Vanilla.*—The finest vanilla is still produced in Mexico, where it has been cultivated for nearly a century. Mr. C. E. Hires (*loc. cit.*), states that the pods are collected in the fall, November or early December, when nearly mature; the processes of curing, sorting, and packing requiring from four to five months, the crop of this year reaches the market in the spring and summer of the next. The erroneous statement is still made in the U. S. Dispensatory that the fruit is collected in the spring. This is the time of flowering, but according to all authorities it will require nearly six months for the fruit to be perfected. Since the extensive cultivation of vanilla in Réunion and other French provinces, the exportation of the Mexican to France has rapidly declined. At the present time, the United States afford the principal market for this product. The receipts for recent years were as follows:—

| — | Cases. | Lbs. |
|---|---|---|
| 1885 - - | 806 | 100,750 |
| 1886 - - | 605 | 75,625 |
| 1887 - - | 1,023 | 127,875 |
| 1888 - - | 829 | 103,625 |
| 1889 - - | 852 | 106,500 |
| 1890 - - | 947 | 118,375 |
| 1891 - - | 1,087 | 135,875 |

The crop of 1890–1891 was the largest ever grown. Prime Mexican vanilla is from 8 to 10 inches long, flattened, and about $\frac{3}{8}$ inch in diameter at the broadest part. Its upper end or end of attachment tapers gradually for about one-quarter the length of the pod, and is usually curved and slightly twisted toward the point. The lower end is but very slightly attenuated. The colour is a dark brown, and the odour is pleasant, aromatic, and characteristic. The surface is ridged longitudinally, the ridges being interspersed with finer striations and warty excrescences. The pod feels firmly plump, and while fresh the surface is somewhat viscid; but, nevertheless, there is a roughness to the touch, which becomes more pronounced as it gets older and drier. Acicular crystals commence to form at the ends and gradually extend over the surface. The interior is filled with numerous small black seeds and a small quantity of pulp.

*Bourbon Vanilla.*—The cultivation of vanilla in Réunion was commenced nearly half a century ago, and has been steadily on the increase until now probably 3,000 acres are under cultivation. In 1849 only 3 kilogrammes were exported from Réunion, in 1861 this had been increased to 40,000 lbs., and in recent years has not fallen below 200,000 lbs. The quality of the Bourbon vanilla has likewise undergone considerable improvement, so much so that many of the published descriptions in the text-books do not fairly describe the product in our markets to-day. The best qualities are from 7½ to 8½ inches long, and $\frac{1}{4}$ to $\frac{5}{16}$ inch in width at the broadest part. The lower end is but slightly attenuated, and the upper gradually tapers, commencing about 1½ to 2 inches from the point, and is twisted and turned in. In size and general appearance they closely resemble the Mexican, and are now packed in bundles closely simulating that variety. In colour they are of a dark brown, almost black. The odour is not unpleasant, but is unlike the Mexican, being more like that of Tonka. The difference in odour becomes very pronounced on steeping a piece in hot water. The surface

is longitudinally wrinkled, the striations being coarse and deep. To the touch the *surface is smooth and waxy*, and soon *becomes covered with a coating of acicular crystals*, known in the trade as "*frost*." It is not as firmly fleshy as the Mexican. The vanillas from the Seychelles and Mauritius are commonly sold in this country as inferior Bourbon. The total imports of the three varieties in 1891 amounted to about 10,000 lbs.

*Vanilla from the Seychelles and Mauritius.*—These varieties are very similar in character. Samples of Seychelles examined were 6 to 6½ inches in length, not much flattened, being in many instances nearly round and only $\frac{3}{16}$ to ¼ inch in width, tapering for about 1 to 1½ inches to the upper end, which is generally twisted. The longitudinal ridges are broad and flattened. It is characterised by its pale colour, faint odour, and small size. After a time a few crystals appear on the surface, which is smooth, but not as waxy as that of the Réunion vanilla. These crystals frequently assume a flat or tabular form.

The Mauritius fruit is similar to the Seychelles in colour, shape, and surface characters, but is generally somewhat smaller.

*South American Vanilla.*—Recently the quantity of South American vanilla imported has been quite large. In 1891 it amounted to about 9,000 lbs. The principal outlet is most likely as an adulterant of the Mexican cut beans, as in this form it becomes a dangerous adulterant. In the entire bean the difference is easily recognised. It is from 6½ to 7½ inches in length and quite broad and flattened, being usually ½ inch or more wide, slightly tapering at the lower end, and at the upper quite sharply attenuated an inch or so from the point. The colour is of a reddish-brown and the odour is rank, resembling somewhat that of fermented molasses or rum. It is *very pulpy* and extremely resinous. The surface is distinctly wrinkled and smooth, being intermediate in feel between the Bourbon and the Mexican.

The pods appear to be collected when nearly ripe; frequently they are split and seeds are seen all over the surface. There are but few crystals appearing on the surface. Transverse sections showed the pericarp to be very thin at the edges and to consist largely of broken down, dark reddish-brown cells.

*Tahiti Vanilla.*—The vanilla produced in the island of Tahiti and in the Sandwich Islands is all sold under the name of Tahiti vanilla. It is largely consumed on the Pacific Coast and in the Western States. Some years ago a considerable quantity was disposed of in Philadephia among the retailers, being offered as *transplanted Mexican.*

The imports in 1891 amounted to 5,000 lbs. They are 6 to 7 inches long, broad and flat, about ⅜ to ½ an inch in width. The colour, odour, and external marking are similar to the South American. They taper for a short distance to the lower end, and are sharply attenuated and twisted toward the upper end. They are likewise very pulpy.

*Vanillons.*—While some few wild or uncultivated vanillas are collected in Mexico, the bulk of those entering commerce are obtained from the West Indies, Guadaloupe and Martinique being the principal places of export. Their principal consumption is among the tobacco manufacturers, and perfumers, for the manufacture of sachet powders.

They are from 4 to 5 inches in length, ⅜ to ¾ or even 1 inch in diameter, frequently sharply angled, exhibiting almost a triangular shape on cross-sectioning. They are nearly the same diameter for the greater

portion of their length, being attenuated at both ends. They are brown to a red-brown in colour and longitudinally rigid. The transverse markings, due to their being wrapped with twine during the process of curing, give them a curious twisted appearance. They are generally split open and lack almost entirely the odour of vanillin, their odour being compared to a cross between a fermented sugar and heliotrope odour. They are devoid of any crystalline efflorescence.

## CCLXVI.—MISCELLANEOUS NOTES.

The Museum of the Royal Gardens contains numerous illustrations of the applications of CORK, the bark of the Cork Oak (*Quercus Suber*, L.). The tree grows in Spain, Italy, South of France, and Algeria, and the first crop of cork is taken from the trunk as it stands, at the age of about 30 years, and afterwards at intervals of from six to 10 years. The later crops furnish the best bark, which is used for bottle corks and similar purposes. The Museum collection has just been made more complete by the addition of an axe, scraper, and knife, such as are used in collecting cork in Algeria. These have been presented by Mr. Vice-Consul Scratchley, of Philippeville, Algeria.

Samples of ANNATTO Seeds and Annatto Dye from *Bixa Orellana*, L., have recently been received from E. H. Man, Esq., grown and prepared in the Andaman and Nicobar Islands. The seeds were of a bad colour, and the so-called dye apparently consisted of the coloured portion of the seed reduced to powder, five ounces of which were obtained from one pound of seeds. Upon submitting these samples to Messrs. Fullwood and Bland, the well-known annatto makers, they reported that both the seeds and prepared dye were valueless in the English market. The fact is, Ceylon now supplies annatto dye of such excellent quality that other countries can scarcely compete with it, except when prices are exceptionally high.

In consequence of the great demand for GUTTA PERCHA, any new substance of a similar nature is looked upon with keen interest. A specimen of Gutta, obtained from *Dichopsis obovata*, C. B. Clarke, has been received at Kew from Mr. H. M. S. Mathews, Officiating-Director of Land Records and Agriculture, Burma. The Gutta was obtained from the Tenasserim Division, in the southern part of which the tree is said to occur in considerable numbers. The sample received at Kew weighed 26 ounces, and is the produce of one tree. It was thought that if the substance was found to be of fair market value, a trade of some importance might be established in it. Upon submitting the sample in question to Messrs. Hecht, Levis, and Kahn, of London and Liverpool, they reported as follows:—"This is not real Gutta Percha. The sample "contains a large quantity of gum which renders it almost valueless, we "do not think that it would be worth more than one penny, or at the "outside three-halfpence, per pound. It is very brittle."

In the *Pharmaceutical Journal* for July 23rd, 1892, p. 61, Mr. Leonard Wray, Junior, Curator of the Perak Government Museum,

gives an elaborate account of the Malayan fish poison, known as "Aker Tuba," and furnished by the roots of *Derris elliptica*, Benth. To prepare it for use, the roots are pounded or ground into a fine powder and mixed with stiff clay and crushed refuse, such as shrimps or small fish. This mixture is made into balls and dried, and these balls are thrown into the sea like ground bait. In the rivers the Malays take one or more dug out canoes, according to the size of the stream to be operated upon, and partly fill them with water and pounded roots. The boat or boats are then upset into the river and drift down with the stream, whilst with nets and spears they secure the fish as they rise stupefied to the surface. Mr. Wray says that the root is also largely used by the Chinese market gardeners as an insecticide, for which purpose the fresh roots are finely chopped and pounded and mixed with water, which becomes milky, and this is sprayed or brushed over the plants with a bunch of feathers. It is said that 20 grains of the green root will render one gallon of water sufficiently poisonous to kill fish. The plant was referred to in the *Report of the Royal Gardens, Kew*, for 1877, p. 43, and is at present growing in the Economic House. The dried roots are shown in the Museum No. I.

Mr. F. M. Bailey, F.L.S., the Colonial Botanist at Brisbane, has recently sent to the Kew Museum some sporocarps of the Nardoo (*Marsilea Drummondii*, A. Br.), and cakes made from them by the natives of the Diamantina district. This species is described in the *Flora Australiensis*, vol. vii., p. 684, as yielding "a miserable article of food under the name of *Nardoo*." It will be remembered that the "Nardoo" formed the only food for some time of the unfortunate Australian explorers Burke and Wills. Mr. Bailey says in the letter accompanying the specimens :—"I have just received from Dr. T. L. Bancroft some "samples of Nardoo 'damper' or cakes, made by the natives of the "Diamantina district; I send a few with some of the seeds under separ- "ate cover. The following is the mode adopted in making the cakes or "dampers:—The 'gins' (women) take a handful of the seed and let "two or three at a time drop through the third or fourth fingers on to "a flat stone, then in the other hand they have a stone with which they "beat the seed until it is reduced to a yellow powder, this runs down a "piece of bark into some utensil, when sufficient quantity is obtained "it is mixed with a little water and baked."

Poisonous Leguminous Plant.—Amongst the numerous seeds, fruits, and products that are constantly being received at the Royal Gardens for identification were a few pods with bright-red seeds, which were accompanied by the following account :—

"I take the liberty of sending to you a few pods which I collected in Mexico. The leaves and seeds of this tree are said to be highly poisonous, and to produce tetanus in animals eating them. I have examined some of the seeds to find whether they contain strychnine, but have ascertained that that alkaloid is not present. I shall feel obliged if you could tell me whether you know of this plant and whether you could give me any information with respect to it. I understand that very large quantities of these seeds can be obtained in the mountains around Zacatecas in Mexico."

Upon examination these seeds proved to be those of *Sophora secundiflora*, Lagasca, described by Professor Sargent as a small tree or all shrub of Matagorda Bay, Texas, west to the mountains of New

Mexico, forming dense thickets on the borders of streams, generally in low rather moist soil. It has a heavy, hard, close-grained wood of an orange colour streaked with red. The seeds are said to contain an exceedingly poisonous alkaloid known as *Sophorine*. The Indians in the neighbourhood of San Antonio use the seeds as an intoxicant, half a seed producing exhilaration followed by sleep lasting two or three days. A whole bean is said to be sufficient to kill a man.

A Handbook of Australian Fungi has been prepared by Dr. M. C. Cooke, A.L.S., Mycologist in the Herbarium of the Royal Gardens, and published under the authority of the several Governments of the Australian Colonies. It contains a full description of all the fungi so far known to occur in Australia and Tasmania, number 2,084 species. All the genera are illustrated by 36 plates, 20 of which are coloured.

Handbook of Irideæ.—Mr. J. G. Baker, F.R.S., has in the press a handbook of Irideæ, uniform with those which he has already published on the neighbouring orders Amaryllideæ and Bromeliaceæ. The order contains about 60 genera and 800 species, nearly half of the latter being concentrated at the Cape. The large garden genera of the order are *Crocus*, *Iris*, and *Gladiolus*. More than one-half the book is already printed, and it will be completed in a few weeks.

New Cape Liliaceæ.—Mr. J. G. Baker has published in a recent number of *Engler's Jahrbuch* (vol. XV., Part iii, p. 5) descriptions of fifteen new species of Liliaceæ, which were sent to him for examination by Dr. Engler from the Berlin Herbarium. These new species belong to the following genera, viz., *Eriospermum* 1, *Kniphofia* 3, *Tulbaghia* 1, *Urginea* 2, *Drimia* 1, *Dipcadi* 1, *Scilla* 1, *Ornithogalum* 1, *Lachenalia* 2, and *Massonia* 2. The three Kniphofias and several of the others have been collected lately in Pondo-land, which lies on the east coast south of Natal, by a German collector of the name of Bachmann.

New Yucca and Aloe.—Two of the new Liliaceæ seen in a flowerless state in the garden of Mr. Thomas Hanbury, at La Mortola, by Mr. J. G. Baker, during his visit to the Riviera last winter (see the January number of the *Kew Bulletin*) have developed their flowers this summer, and have been fully described by Mr. Baker in the *Gardeners' Chronicle*. These are *Yucca Hanburii* (*Kew Bulletin*, 1892, p. 8), from the Rocky Mountains, a species nearly allied to *Y. angustifolia*, Pursh. (*Bot. Mag.*, tab. 2236), and the Cape Aloe, allied to *Aloe arborescens*, mentioned on page 10 of Mr. Baker's report. The latter is a very distinct plant, and a valuable addition to the small number of large showy species of the genus. It has suberect stems, laxly-disposed lanceolate leaves, a dense raceme of deflexed bright yellow flowers and much-exserted stamens. It has been named *Aloe aurantiaca*, and a full description will be found in the *Gardeners' Chronicle*, 1892, Vol. I., page 780.

The progress made in a Sisal Hemp industry at the Turks and Caicos Islands is discussed as follows in the Blue Book Report (Jamaica) for 1891 :—The cultivation of the Pita (Sisal) plant has made fair progress,

especially in the Caicos Islands, and the reports from the plantations, towards the close of the year, were satisfactory. Two companies, the West Caicos Fibre Company, Limited, at West Caicos, and the East Caicos Company, Limited, at Breezy Point, formed for the purpose of raising pita plants and extracting the fibre, registered under the companies ordinance, and there are several private plantations. A small shipment of fibre was made to New York within the year from one of the latter, and the first quality fetched a cent a pound more than the second quality—an equal price to the best from Yucatan. This speaks well for the quality of the fibre which can be produced in these islands, and promises a bright future for the local fibre industry.

The following note on Fruit Cultivation in the Bahamas is given in the Blue Book Report for 1891:—The Colony offers great inducements for fruit-growing. Pine-apples are at present the principal crop, but the particular description of land required for their culture is a limited quantity. Of late years the growth has been much improved by the use of fertilizers, with a considerable increase of quantity. The crop yields large profits. At twopence each an acre of pine-apples returns 40*l.* to 45*l.*, and, though precarious, from its perishable nature, while such results are possible it will continue to be an attractive pursuit. I do not desire to see it extended, as the sole means of the cultivators, beyond its present limits, for the increasing competition of Cuba and Jamaica is a further element of insecurity in the future of this industry. In oranges a good business might be done, if the accounts of Florida enterprise in this fruit are a fair criterion. At present the oranges of this country are roughly handled, being generally shipped in bulk in vessels' holds, and often without compartments. The fruit is equal to any in the world, and when, for the most part, it receives no attention, the result of careful cultivation could not fail to be remunerative. The facilities for production are fully up to those in Florida, and we are entirely free from all risk of frost, which so often blights the Florida crop. The success of the industry in this Colony would be partial, however, until the proper system of packing were adopted to ensure delivery at market in good condition.

ROYAL GARDENS, KEW.

# BULLETIN

OF

# MISCELLANEOUS INFORMATION.

No. 70.] OCTOBER. [1892.

## CCLXVI.—LAO TEA.

(*Camellia theifera*, Griff.)

Recently a singular method of using the leaves of what has since been proved to be the Assam tea plant of commerce (*Camellia theifera*) was brought before the Society of Arts by Mr. Ernest Mason Satow, C.M.G. Amongst the Laos, a people inhabiting a district of Siam, in the neighbourhood of Chiengimai, the tea leaves are not used for making an infusion as in other countries, but are prepared wholly for the purpose of chewing. The leaves are first steamed and then tied up in bundles and buried in the ground for a period of about 15 days. Leaves thus prepared, called locally "mieng," are said to keep for two years or more. The habit of chewing "mieng" is almost universal among the Laos, and to men engaged in hard work, such as poling or rowing, it is said to be almost indispensable. The result of an inquiry made by Kew in regard to the plant yielding "mieng" and the method of preparation is detailed in the following correspondence:—

ROYAL GARDENS, KEW, to FOREIGN OFFICE.

SIR, Royal Gardens, Kew, 8th February 1892.

I AM desired by Mr. Thiselton-Dyer to inform you that his attention has been called to an interesting paper on "The Laos States, Upper Siam," recently read before the Society of Arts by Mr. Ernest Mason Satow, C.M.G., late Minister Resident and Consul-General at Bangkok.

2. In the course of this paper, as shown in the extract enclosed, Mr. Satow drew attention to the use of "mieng" or Lao tea. It appears that the Laos do not drink the infusion of this tea, but prepare the leaf for chewing by burying it in pits. It is said to be one of their indispensable luxuries.

3. It is not clearly established that this Lao tea is identical with that obtained from the true tea plant. In any case the particular way in which it is used is certainly singular, and the subject deserves to be more fully investigated.

4. Mr. Thiselton-Dyer would therefore be glad to obtain through the kind offices of the Secretary of State specimens of the leaves and flowers

of the plant yielding Lao tea; also a sample, about half a pound in weight, in a dry state, of the fermented article as prepared ready for chewing.

I have, &c.
(Signed) D. Morris,
Assistant Director.

Sir Villiers Lister, K.C.M.G.,
Foreign Office, S.W.

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[Enclosure.]

Extract from Paper on the Laos States, Upper Siam, by E. M. Satow, C.M.G. *Journal of the Society of Arts.* January 22nd, 1892, page 194.

"The path at first winds round the top of a pine-clad spur stretching towards Doi Suthĕp and then plunges down a declivity in a north-east direction, bringing us to the hamlet of Pong-yeng. Just at the bottom of the hill we passed a plantation of *mieng* or Lao tea. The natives call these plantations *pa-mieng* or tea-forest; if *pa* be rendered literally this term causing it to be generally supposed that the *mieng* grows wild. Laos tell you that it is found growing in commixture with other trees which are cut down, leaving the tea-tree to benefit by the additional air and sun. But this account seems doubtful. It is possible that the Laos of Chiengmai, when the country was resettled, found old tea-trees growing in this way, and cleared them from the jungle which enveloped them, but the arrangement of the trees is too regular to allow of our supposing that they were planted by the mere hand of nature. Many were 12 to 15 feet high, with stems two and a half to three inches in diameter, and they were evidently not pruned. Some were in bud or flower and others bore the half ripe berry. The leaf is longer and more pointed than that of the Japanese tea-plant and the foliage is less dense. But of its being a species of tea there can be no doubt whatever. The Laos do not drink the infusion, but prepare the leaf for chewing by burying it in pits, and it is one of their indispensable luxuries. You see a man put a lump of the fermented leaves in one cheek, which he leaves there while he proceeds to chew betel or smoke a cigarette, looking for all the world as if his face were distorted by the mumps."

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Foreign Office to Royal Gardens, Kew.

Sir, Foreign Office, September 8th, 1892.

I am directed by the Earl of Rosebery to transmit to you the enclosed copy of a despatch from Her Majesty's Minister in Siam respecting the specimens of Lao tea which were asked for in your letter of the 8th of February last.

The specimens have been despatched from Singapore, and will be forwarded to you as soon as they arrive at this Office.

I am, &c.
(Signed) T. H. Sanderson.

W. T. Thiselton-Dyer, Esq., C.M.G.
Kew Gardens.

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[Enclosure.]

My Lord British Legation, Bangkok, 21st July 1892.

With reference to your Lordship's despatch, No. 3, of the 11th of February last, stating that the Director of the Royal Gardens, Kew,

was anxious to procure specimens of "mieng" or Lao tea, I have the honour to state that specimens of the plant and its flowers, together with a quantity of the fermented article ready for chewing, obtained by Mr. Stringer, Acting Vice-Consul at Chiengmai, have been forwarded by this mail to the Foreign Office.

The specimens of the plant have been sent by the agents of the Ocean Steamship Company, Singapore, who will transmit the bill of lading to London and the packet of the fermented article and flowers by parcel post from Bangkok.

I enclose herewith a report by Mr. Stringer on the culture and use of Lao tea.

I have, &c.
(Signed) HENRY M. JONES.

The Marquis of Salisbury, K.G.

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REPORT on the CULTURE and USE of "MIENG" or LAO TEA.

On May 3rd, 1892, I paid a visit to "Pa mieng" (literally tea forest) or place where the Lao tea plant grows, and the leaves are prepared for chewing, in order that I might, in accordance with instructions received from H.M. Minister-Resident at Bangkok, obtain specimens of the tea and report on the culture and use of it. The forest visited was near a hamlet of about 20 houses, called Kong Hë, distant about 25 miles from Chiengmai and about five miles from Pong Yeng, the village near which Mr. Satow met with the tea plant as mentioned in his paper lately read before the Society of Arts. This forest is a much smaller one than some of the others near Chiengmai, but has the advantage of being much nearer to the city. It is situated on the north-western slope of the mountain range near Chiengmai, at an altitude of about 2,000 feet.

The tea trees were growing in abundance near the village, and close together. It is not correct to say, as the Laos sometimes do, that all the trees are self sown, and all that is done is to cut down the surrounding jungle, leaving the tea tree free to benefit by the air and sun, as I was informed by the tea pickers here that new trees were obtained by planting the seed. When the tree grows to such a height that the leaves of the top branches are bent down, the larger branches are cut off at the stem, and the tree produces new branches.

There are four seasons for picking the leaves in a year, the first in the eighth Lao month (April–May), the second in the ninth month (May–June), the third in the twelfth month (September–October), and the fourth in the second month (November–December). The picking goes on for about a month in the first two seasons, and for a shorter time in the third and fourth. The first two pickings produce the largest crop of leaves, the third produces less than these, and the fourth less than the third. The leaves of the first picking are considered the best.

In gathering the leaves only the young ones are taken, and the upper portion of the leaf is nipped off with the fingers, about a quarter of the leaf being left attached to the tree. If the whole leaf is picked, the young branches from which the leaves are picked off die. Each handful of leaves as it is gathered is tied tightly together. The picking takes place in the early morning, and about mid-day the leaves are steamed. This process takes place in a shed built for the purpose, and provided with one or more furnaces. The furnace consists of a hole in the ground, and over this is placed an earthen pot or chatty containing water. The "mieng," tied in small bundles or handfuls, is placed in a wooden

cylinder, about 24 inches in height and 15 inches in diameter. At the bottom of the cylinder is a network of small strips of bamboo. This cylinder is suspended over the earthen pot, and round the edge of the pot is placed a wet cloth, so that all the steam may pass up through the cylinder. When the "mieng" has been thoroughly steamed, which is ascertained by its having sunk down to a certain point in the cylinder, it is left to cool and then taken out and retied, as the bundles have decreased in size, and it is then ready for use. If, however, the "mieng" is to be kept for any length of time, it is placed in small pits dug in the ground and lined with large leaves, and it is then well trodden down to press out as much of the liquor as possible. It is then covered up with leaves and large stones are placed on the top, and it is left thus buried for about 15 days. I am informed that "mieng" which has been pressed and buried in this way will keep for two years. If the "mieng" is required for immediate consumption it is not necessary to bury it, but it is packed in large baskets, and large stones are placed on it to press out the liquor. The liquor which is left in the pot after steaming the "mieng," and which is of a dark reddish-brown colour, is used as an article of food by the Laos and Siamese. The habit of chewing "mieng" is almost universal among the Laos, and the men engaged in hard work, such as poling or rowing boats, a quid of "mieng" seems to be almost indispensable. It appears to have the same effect upon the nerves as that of drinking tea.

The price of the prepared article at the village which I visited was one rupee (1*s.* 3*d.*) for 12 packages, a package containing 10 bundles or handfuls. In Chiengmai from 7 to 10 packages are sold for one rupee. A bamboo joint containing three bundles of the prepared mieng is forwarded with this report, also some dried leaves and flowers of the shrub and some young plants. At the time of my visit to the tea garden flowers were scarce, as the shrub flowers later in the year.

(Signed) C. E. W. STRINGER.

The specimens forwarded to the Foreign Office were duly received at Kew, and they are deposited in the Museums of Economic Botany. The specimens of flowers and leaves were found to be identical with the indigenous tea of Assam (*Camellia theifera*, Griff.). The young plants, however, did not reach Kew alive. This, under the circumstances, was not a matter of much moment, as both the Assam and China tea plants of commerce are well represented in the Kew collections.

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## CCLXVII.—CHINESE SILKWORM GUT.

In the Foreign Office Report on the trade of Kiungchow [F. O. Annual Series 1891, No. 898] the following account is given of a wild silk found in the neighbourhood of Kiungchow, and utilised locally for fishing lines:—

"A very strong silk is made from the grub called the 'celestial silk-worm' ('t'yn ts'am'), or, locally, 'paddy insect' ('din t'ang). This grub is found on a sort of maple, the fêng tree, or *Liquidambar formosana*, Hance. When the insect is full grown it is thrown into boiling vinegar, on which the 'head' of the gut or 'silk' appears; this is sharply torn out with both hands drawn apart, and is as long as the

space between them, say five feet; it is so strong that one single thread of it is sufficient to make a line with which to catch the smaller kinds of fish."

The same subject is referred to again in the Foreign Office Report on the trade of Kiungchow for the current year [F. O. Annual Series, 1892, No. 1026]:—

"I enclose with this report, for transmission to Kew, a specimen of the very tough 'wild silk' of my last report, locally used for fish lines. The 'taotai' of Hainan informs me that, according to popular report, the insect is produced upon the 'fêng' tree, or *Liquidambar formosana*, Hance.

"In Canton it is called 'yü-sz,' or 'fish silk,' also 'yü-sz t'an,' or 'fish silk head.' In Hoihow it is called 'hang-ti' (ch'ung-sz), or 'insect silk,' and it is said to cost 60*l.* the $133\frac{1}{3}$ lbs., or 1,000*l.* the ton. Another account says that the insect which produces this tough silk is found everywhere, but is seen at its best in Hainan, on the summits of isolated mountains in the 'Lai-mui' (Ling-mên) neighbourhood. In the early summer (3rd and 4th moons) of each year the insect feeds on the leaves of the 'chang' (or ? camphor) tree, and dies when the leaves fall off. The male produces a single and the female a double thread of silk, that produced by the female being, however, of inferior quality. Specimens of the insect were promised me for the month of April, but I regret to say that I shall not be in a position to welcome their arrival."

The specimens mentioned in the latter extract were received from Mr. Acting-Consul Parker, and are now in the Kew Museum. The production of silk-gut in China is a subject that was very prominently brought forward by Mr. Consul Swinhoe nearly a quarter of a century ago. The following extracts are taken from the correspondence which took place at that time, to supplement the information now given by Mr. Parker:—

### FOREIGN OFFICE to ROYAL GARDENS, KEW.

SIR, Foreign Office, May 7, 1867.

I AM directed by Lord Stanley to transmit to you a copy of a despatch from Her Majesty's Consul at Amoy, containing information in regard to a silk-producing caterpillar which is found in that part of China, and forwarding specimens of silkworm gut drawn from this caterpillar by the natives.

I am, &c.
(Signed) E. HAMMOND.

Dr. Hooker,
Royal Gardens, Kew.

### H.B.M. CONSUL, Amoy, to FOREIGN OFFICE.

MY LORD, British Consulate, Amoy, March 11th, 1867.

COMMERCIAL men may like to learn that in the south of China a silk-producing caterpillar is found on the leaves of a forest tree. I have the honour to enclose some pieces of silkworm gut drawn from this caterpillar by the natives of this district. This appears to be the sole use to which the creature is here applied. For this purpose it is not reared in captivity, but captured on its descending from the tree to spin its cocoon in the earth previous to its transforming into the chrysalid state. The matured worms are steeped in vinegar for a day and then drawn out into gut, which is used for fishing lines and for various economical and ornamental purposes.

I have not been able yet to procure the insect so as to ascertain whether it be known or not to naturalists, but as soon as the season comes round I have no doubt that I shall be able to do so. The curious fact regarding it is that it subsists on the leaves of a Liquidambar, a tree that flourishes from Canton to Nanking and in Formosa, and of which a near ally, *L. styraciflua*, thrives in North America. So that if eventually it be found worth while to cultivate the insect for the sake of its silk, I should think it would be no great difficulty to educate it to feed upon the leaves of that American forest tree.

The late Mr. Oldham, travelling botanist for Kew Gardens, and myself in 1864 first procured this tree at Tamsuy, Formosa. We sent specimens of it to Dr. H. F. Hance, H.M. Vice-Consul at Whampoa, who is the botanical authority in China, and he described it as a new species of Liquidambar, and named it *L. formosana*. It formed one of the most conspicuous trees in the mountain forests of Formosa. On my return to Amoy last year I found it abundant in the woods of the interior here, and wrote and informed Dr. Hance of the fact. Dr. Hance replied that he had also seen it common about 120 miles above Canton, and that it was there called the "Bastard Chestnut," and that "a caterpillar feeds on it, the chrysalis of which yields a coarse silk."

* * * * * *

The mention of the silkworm incited me to make every inquiry about the tree at Amoy, and as I have above stated I find that such a worm does also occur on the tree here, but that it is only used for silkworm gut.

The *Liquidambar formosana*, Hance says, is known to the Chinese as the Fung (or Feng) tree. The Chinese Gazetteer of Formosa gives the name as of a tree occurring in Formosa but nothing more. The Chinese standard Dictionary of Kanghe gives a peculiarly Chinese account of it, but makes no allusion to the caterpillar.

* * * * * *

I learn from the natives that the bark is fragrant when charred, and that a decoction of the leaves is used as a stomachic. A resinous sap is tapped from the tree which is sometimes used in lamps in place of oil.

* * * * * *

As so much interest is now taken in silk-producing insects, no further excuse may be needed for my boldness in communicating the information for your Lordship's consideration. I trust in due course of time to be able to lay before you some particulars about the worm itself.

I have, &c.
(Signed) Robert Swinhoe,
H.B.M. Consul at Amoy.

The Lord Stanley.

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H.B.M. Consul, Amoy, to Foreign Office.

My Lord, British Consulate, Amoy, 10th April 1867.

Referring to my despatch of 11th March 1867, I have now the honour to forward a few cocoons of the silk-producing worm of the *Liquidambar formosana*, Hance. I have not yet seen the moth, but judging from the cocoon, it is pretty certain that we have here no Bombyx. The cocoons are worked by the insect on the bark of the tree, and are so hard, coarse, and thin, that in the first place it can be no easy matter to

unravel the silk, in the second, when unravelled, the silk could only be converted into very coarse textures, and in the third place, there is apparently so little of the silk that it is doubtful whether it would ever be worth while to attempt to acclimatise and domesticate the insect in the west. I have already informed your Lordship that in this district the Chinese use this worm only for the purpose of making silkworm gut, but that I had been informed that in the Canton province, the silk, such as it is, is woven. Only lately Dr. H. F. Hance, H.B.M. Vice-Consul at Whampoa, wrote to tell me that the cocoons are sent from the Canton district to Chinchan, bordering on Fokien, and there manufactured; I have not, however, succeeded in procuring a sample of this manufacture. I have myself no great hopes of the usefulness of this cocoon among European cultivators, I, nevertheless, take the liberty to forward the few specimens that I have been able to acquire that their value may be tested by qualified persons. Two or three of the enclosed cocoons contain live pupæ.

In conclusion, I may remark that the true silkworm is only reared here in small quantities, and more as an amusement for Chinese families than for commercial purposes.

I have, &c.

The Lord Stanley. (Signed) R. Swinhoe.

P.S.—I am forwarding to the Royal Gardens, Kew, a few live bushes of the *Liquidambar formosana.*

(Signed) R. Swinhoe.

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The specimens of gut sent by Mr. Swinhoe were submitted by Sir Joseph Hooker to the late Mr. Daniel Hanbury, F.R.S., and his opinion upon them was as follows:—

"Silkworm gut is manufactured in Spain by a process which is briefly and clearly described in Ure's *Dictionary of Arts and Manufactures.* The process described by Mr. Swinhoe is essentially the same. The sample which he has sent is, however, as I am informed on good authority, not first rate, yet not so bad as to be unsaleable in the market here. *Good* silkworm gut is evenly round like wire, silky, bright, and colourless. The *thickest* and *longest* is most in request, and such quality is scarce. *Fine* is also in demand.

"The article is usually put up in little bundles of 100 threads each, and these again in tens."

The article in Ure's *Dictionary of Arts and Manufactures and Mines* mentioned by Mr. Hanbury is found in Vol. II., p. 619. Silkworm gut for angling is made as follows:

"Select a number of the best and largest silkworms, just when they are beginning to spin, which is known by their refusing to eat, and having a fine silk thread hanging from their mouths. Immerse them in strong vinegar, and cover them closely for 12 hours, if the weather be warm, but two or three hours longer, if it be cool. When taken out, and pulled asunder, two transparent guts will be observed, of a yellow green colour, as thick as a small straw, bent double. The rest of the entrails resembles boiled spinach, and therefore can occasion no mistake as to the silk gut. If this be soft, or break upon stretching it, it is a proof that the worm has not been long enough under the influence of the vinegar. When the gut is fit to draw out, the one end of it is to be dipped into the vinegar, and the other end is to be stretched gently to the proper length. When thus drawn out, it must be kept extended

on a thin piece of board, by putting its extremities into slits in the end of the wood, or fastening them to pins, and then exposed in the sun to dry. Thus genuine silk gut is made in Spain. From the manner in which it is dried the ends are always more or less compressed or attenuated."

In a further report, dated 23rd July 1867, Mr. Swinhoe communicated to the Foreign Office the following notes on the Chinese Liquidambar Silkworm :—

"Near the end of June small boys are set to watch under the trees for the worms to descend, lowering themselves on their own threads. They do not come down until they are ready to spin. As soon as a worm descends it is at once caught and broken, and the silk-gut there and then extracted, steeped in vinegar, washed and drawn out. The small boys are always provided with vinegar and water when in the capture, as the operation brooks of no delay. If the worms are kept at all the gut is useless and will not draw. Each gut, if properly managed, will draw out to 20 or 30 feet. The gut is dried in a shady place, and is then rolled up and considered ready for use."

The specimens so far received of this silkworm consist of cocoons only, and it has been impossible to determine it from these alone. It may possibly be *Attacus Pernyi*, but the imago or mature insect is necessary to settle the point. The cocoons sent by Mr. Swinhoe are attached to the bark of a tree, and are of a dull grey colour. The upper narrower end forms a natural orifice for the exit of the moth, and hence the cocoons are not closed like those of the ordinary silkworm. It is possible that the silk from these open Chinese cocoons, as anticipated by Mr. Swinhoe, may not be of any special value. Some fabrics, have, however, been made from the silk, and specimens were forwarded by Mr. Swinhoe. These unfortunately were required by the Secretary of State to be returned to the Foreign Office in 1868 for the information of the Board of Trade. Mr. Swinhoe stated that the fabric to which he refers as "'crape pongee' could not meet the demand, and " the stuff eventually got out of fashion, though many still wear it [in " 1867] at Chaochowfoo." He adds, "it is mostly spun for home use and " for trade on special demand."

In a letter addressed to Kew, dated Foochow, May 31, 1892, Mr. F. Cave Thomas evidently refers to the silk-gut from the same insect as follows :—

"Enclosed I take the liberty to send you a specimen of a product yielded in this part of China by a worm (somewhat akin to a silkworm), and in considerable demand for the purpose of making fish lines. Would it be asking too much of you to give me your views upon the probability of introducing this commodity into use in England for a similar purpose . . .

"It seems so strong and serviceable that there should be an opening in England if some one would take the matter up.

"I beg to thank you for any assistance you can afford me. It costs about 6*s*. 6*d*. to 7*s*. per pound."

Messrs. Charles Farlow & Co., Fishing Tackle Manufacturers, 191, Strand, to whom Mr. Thomas' specimens were referred, state that the "gut" they use is from the ordinary silkworm, and it can only be obtained (exactly as they wish it) from Spain. The Chinese gut they describe as "very similar to what we have seen many years ago, perhaps " not quite so brittle. It could not be used for fishing purposes, and " we do not know for what purpose it could be used."

In a *Handbook of British Commerce* by Mr. P. L. Simmonds, F.L S., 1892, p. 153, silkworm gut is described "as an animal fibre used for " making leaders for fishing lines, imported from China obtained by " steeping the silk caterpillar in vinegar. One hundred and fifty, " hundredweights are sometimes shipped to Europe from one port, " Kiungchow."

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## CCLXVIII.—MANGROVE BARK AND EXTRACT.

(*Rhizophora Mangle*, L.)

The bark of the common Mangrove tree, which constitutes the chief arboreal element in the mangrove groves along the low coasts of the western tropics, is well known to contain an abundance of tannin. It is often used locally for tanning leather, and occasionally it is exported to this country. Some shipments of dried mangrove bark made from Trinidad last year were said to realise about 15*l*. to 18*l*. per ton. Since that time, however, the abundance of tanning materials in the market has caused a considerable fall in prices, and, as will be shown later, mangrove bark just now is practically unsaleable. In these shipments from Trinidad the bark was dried and broken in small pieces and shipped in gunny bags. A report upon a sample of Trinidad mangrove bark, communicated to Kew by Dr. Chittenden, Secretary of the Central Agricultural Board, is here reproduced:—

Victoria Chambers, South Parade, Leeds,
17th March 1890.

We have examined a sample of bark received from Messrs. A. L. Young & Co., Trinidad, on the 11th instant. The sample was broken up, and contained a considerable quantity of dust. It was very readily extracted with hot water, and gave an infusion of a light reddish-brown. An analysis gave the following results:—

| | | | |
|---|---|---|---|
| Total extract - - - - | | 33·04 | per cent. |
| Tannin, by hide powder - | 25·10 | | " |
| Other matters - - | 7·94 | | " |
| Insoluble - - - - | | 52·85 | " |
| Moisture - - - - | | 14·11 | " |

On boiling with dilute acid the tannin was almost entirely converted into an insoluble "red" (phlobaphene). The solution yielded only a trace of gallic acid. Heating the tannin to 200 deg. C. had the same effect.

The infusion of the bark gave the following reactions:—

With ferric chloride, dirty brown colour; on adding ammonia, dark chocolate-brown precipitate. With tartar emetic, no precipitate; on adding ammonia chloride, light coloured precipitate. With cupric sulphate, no precipitate; on adding ammonia, reddish precipitate. With lead nitrate, light coloured precipitate. With lime water, reddish-brown precipitate. With strong sulphuric acid, crimson colour. With bromine water, yellow precipitate.

The tannin is a catechol tannin, and resembles mimosa bark to some extent, but is not identical therewith.

It differs in its reaction from the general known tannins, and *its effect in tanning can only be found by experience.*

The bark contains a considerable quantity of tannin, and we are of opinion will prove a valuable addition to our list of tanning materials.

(Signed) Hunt and Mackay.

In order to lessen the bulk and the freight charges on the crude mangrove bark, an effort has been made to extract the tannin from it locally, and forward the latter, in the form of a hard paste or cutch, to this country. Various experiments have been made from time to time in this direction. The latest of these experiments was tried at Jamaica, and the result, though unsatisfactory at the moment, may usefully be placed on record for the guidance of those who may be interested in the subject in other colonies.

Director of Public Gardens and Plantations, Jamaica, to Royal Gardens, Kew.

Dear Dyer, Kingston, Jamaica, 21st November 1890.

I send by same post a block of concentrated juice of the mangrove (*Rhizophora*) bark. The bark is used here extensively for tanning, and it occurs to me that the tannin extracted in this form might be of considerable commercial value. The stir about the exhibition is bringing forward many experiments which otherwise might not be noticed. I should be very glad if you could get an opinion for me as to the commercial value of the mangrove juice.

Yours, &c.

The Director, Royal Gardens, Kew. (Signed) W. Fawcett.

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The Right Hon. W. L. Jackson, M.P., to Royal Gardens, Kew.

Treasury Chambers, Whitehall, S.W.,

Dear Mr. Thiselton-Dyer, 7th March 1891.

I must apologise to you for not sending earlier the analysis obtained of the sample of extract which you forwarded to me. I now beg to enclose it.

Following our conversation on the subject, I think the most practical way of testing the commercial value of the extract would be to obtain a trial by several firms. If your friends in Jamaica will send a quantity, say 20 cwt. of it, I will endeavour to obtain the practical opinions of several of the tanners in this country, and I shall be glad to protect the interests of your friends by insuring to them the full commercial value. If your friends decide to adopt this course, I think the best plan would be to consign it to Messrs. Dalton and Young, Brokers, of 29, Mincing Lane, London, E.C. This firm probably does the largest business in gambier of any firm in this country, and are thoroughly responsible and respectable people, with whom I have done business a great many years.

If I can be of any further assistance pray command me.

Yours, &c.

(Signed) W. L. Jackson.

W. T. Thiselton-Dyer, Esq., C.M.G., F.R.S.,
Royal Gardens, Kew.

[Enclosure.]

Victoria Chambers, South Parade, Leeds,
8th January 1891.

The sample of extract received from the Right Hon. W. L. Jackson, M.P., Buslingthorp, yesterday, contained :—

| | | | |
|---|---|---|---|
| Total extract - - - - | | 82·00 | per cent. |
| Tannin, by hide powder - | 58·30 | | ,, |
| Other matters - - | 23·70 | | ,, |
| Insoluble - - - - | | 1·95 | ,, |
| Moisture - - - - | | 16·05 | ,, |
| | | 100·00 | |

According to the analyses done by Mr. Hunt at Buslingthorp, "bale" gambier contains from 30 to 35 per cent., and "cube" gambier from 45 to 50 per cent. tannin. As gambier gives a different tannage to other materials, a comparison of the amount of tannin in gambier with that in other extracts does not represent comparative values.

(Signed) Hunt and Mackay.

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Extract from Article on the Raetown Tannery in a Supplement to *Gall's Weekly News Letter*, Jamaica, June 13, 1891.

"The liquor may be made in various ways. In England, for instance, they use oak bark, but in Jamaica the leaves of the divi divi and the roots of the mangrove tree are mixed and used, and this latter tan pickle is acknowledged to be superior to any other kind. The roots and leaves used in the Raetown tannery are brought from the Palisadoes by the boat load. Before being steeped they are crushed in an old fashioned mill, of which one may get an idea by revolving a penny on its edge in a saucer. The stone used is an unusually large one and two more like it lie half buried in corners of the building. The proportion in which the leaves and roots are mixed is of course not for everyone to know. Every business has its secrets and the old foreman of the tannery has his like the rest."

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Colonial Secretary, Jamaica, to Director of Public Gardens and Plantations.

Sir, 21st June 1892.

With reference to your memorandum of the 9th February last, and the letter to you from this office, No. $\frac{977}{1336}$, of the 18th idem, I am desired by the Governor to inquire whether any steps have been taken by you in the direction of placing the supply of concentrated mangrove extract, therein referred to, on the home market, in accordance with his Excellency's desire, which it is understood was communicated to you by the Secretary of the Exhibition Commissioners.

I have, &c.
(Signed) Neale Porter,
Colonial Secretary.

W. Fawcett, Esq., F.L.S.

DIRECTOR OF PUBLIC GARDENS AND PLANTATIONS, JAMAICA, to the COLONIAL SECRETARY.

SIR, 24th June 1892.

IN reply to your letter, No. $\frac{5551}{22761}$, dated the 21st instant, I have the honour to inform you that the supply of concentrated mangrove extract referred to was shipped in the month of April, consigned to Messrs. Dalton and Young, Brokers, of Mincing Lane, London, who have undertaken the charge of it with a view to testing its commercial value.

The Right Hon. W. L. Jackson, now Chief Secretary for Ireland, has kindly promised to obtain the opinions of experienced persons on the extract, and the authorities of the Royal Gardens, Kew, have also interested themselves in the matter.

I have, &c.
(Signed) W. FAWCETT.

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ROYAL GARDENS, KEW, to MESSRS. DALTON AND YOUNG, 29, Mincing Lane, E.C.

GENTLEMEN, Royal Gardens, Kew, 3rd August 1892.

WITH reference to a supply of concentrated mangrove extract consigned to you in April last by the Director of Public Gardens and Plantations, Jamaica, for a report on its commercial value, Mr. Thiselton-Dyer would be glad to be informed whether this extract possesses a market value of any importance, and if it is probable that there will be a demand for it in this country.

I have, &c.
(Signed) D. MORRIS.

MESSRS. DALTON AND YOUNG to ROYAL GARDENS, KEW.

29, Mincing Lane, London,
SIR, 6th August 1892.

IN reply to your letter of the 3rd instant in reference to the mangrove extract consigned to us by the Director of the Public Gardens and Plantations, Jamaica, we beg to say that in our opinion the demand, if any, would be very limited for the article. We have submitted it to tanners and others in the trade, but we cannot induce them to try it, all other tanning materials and well-known extracts being so plentiful and never cheaper.

We have sent down a sample drum to the works of the Right Hon. W. L. Jackson, Leeds, and he has promised to test it and give us a report on it. As soon as we receive this we will send you a copy.

We may mention that we have had about 1,000 bales of mangrove bark from Jamaica placed in our hands for sale, but so far we have not been able to find a buyer.

Yours, &c.
(Signed) DALTON AND YOUNG.

D. Morris, Esq., F.L.S.,
Royal Gardens, Kew.

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ROYAL GARDENS, KEW, to COLONIAL OFFICE.

SIR, Royal Gardens, Kew, 9th August 1892.

I AM desired by Mr. Thiselton-Dyer to inform you that in November 1890 there was sent to Kew, by Mr. Fawcett, Director of

Public Gardens and Plantations, Jamaica, a sample of the concentrated juice of the mangrove (*Rhizophora*) bark for tanning purposes.

2. Mr. Thiselton-Dyer interested several persons in this subject and obtained from the Right Hon. W. L. Jackson, M.P., a promise to try the extract in case a sufficient quantity was prepared to be worked on a moderately large scale.

3. The further quantity desired was forwarded by Mr. Fawcett to Messrs. Dalton and Young in April last and it is now in this country. I enclose herewith an interim report from Messrs. Dalton and Young. This report is not of an encouraging character, as the supply of good tanning materials just now is large and the prices consequently very low.

4. In the latter part of their report Messrs. Dalton and Young state that they have had a large quantity (about one thousand bales) of crude mangrove bark from Jamaica placed in their hands, and they have been unable to find a buyer for it. Under these circumstances Mr. Thiselton-Dyer would suggest that a copy of Messrs. Dalton and Young's letter be communicated to the Government of Jamaica in order to inform those interested in the subject that it is undesirable at present to make any further [trial] shipments of tanning substances to this country.

I am, &c.

(Signed) D. Morris.

Edward Wingfield, Esq., C.B.,
Colonial Office, S.W.

Colonial Office to Royal Gardens, Kew.

Colonial Office, Downing Street,
16th August 1892.

Sir,

In reply to your letter of the 9th of August, I am directed by Lord Knutsford to acquaint you that a copy of it will be sent to the Governor of Jamaica with a suggestion that he should issue a public notice that it is undesirable at present to make any further shipments of tanning substances to this country.

I am, &c.

(Signed) Edward Wingfield

The Director, Royal Gardens, Kew.

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Superintendent, Royal Botanic Gardens, Trinidad, to Royal Gardens, Kew.

Trinidad Royal Botanic Gardens,
10th August 1892.

Dear Sir,

Some time since we received a suggestion from London that we might extract "cutch" from mangrove bark. I have to-day sent you a sample which has been prepared in the Gardens under my supervision, and would be glad if you would kindly ascertain through any of your correspondents in the city whether it would have any market value.

I am, &c.

(Signed) J. H. Hart,
Superintendent.

The Director, Royal Gardens, Kew.

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29, Mincing Lane, London, E.C.,
21st September 1892.

Dear Sir,

We have delayed replying to your letter of the 14th ultimo, as we have been hoping to induce some people to try the mangrove extract, but, we regret to say, without success.

On the other side, we hand you copy of letter received from the Right Honourable W. L. Jackson. You will see that he confirms what we wrote to you on 6th August. Just now all kinds of tanning materials are so plentiful and cheap that we cannot induce anyone to trouble to experiment with an unknown article, and of which the supply would be very uncertain. We cannot even sell the mangrove bark to which we previously referred.

We have forwarded a sample to you by Carter, Paterson, and Co., and very much regret that we cannot give you a more favourable report.

We are, &c.
(Signed) DALTON AND YOUNG.

D. Morris, Esq., F.L.S.,
Royal Gardens, Kew.

EXTRACT from letter received from the Right Hon. W. L. JACKSON.

"I have examined the mangrove bark extract, and I regret that I am not able to report very favourably upon it. Gambier at present is much cheaper as a tanner, and I do not think buyers could be found who would pay a proportionate price for this extract.

"I am afraid you will have to tell the consignors that it has come upon the market at a most unfavourable time, and there is no chance its competing with gambier at present prices."

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## CCLXIX.—FOOD GRAINS OF INDIA—(*continued*).

### BLACK BURMESE RICE.

In continuation of previous articles contributed by Professor A. H. Church, F.R.S., on the Food Grains of India,* the following interesting analysis has been made of a black Burmese rice forwarded to Kew, through Dr. Prain, by Dr. King, F.R.S., C.I.E., of the Royal Botanical Gardens, Calcutta.

A rather full notice of this rice, obtained originally from Mr. W. S. E. Landale, has lately appeared in the proceedings of the Agri-Horticultural Society of India, 1892, p. ccxlvi. :—"A sample each of black " and white *Béni* rice was exhibited at the meeting, presented by Mr. " W. S. E. Landale, who furnished the following information :—' The " ' black Burmese *Jooma Choul* is grown by *Mughs* in Chittagong and " ' the Hill Tracts, in the *Jhooms*, or newly cleared jungle land. This " ' paddy is sown in April and cut in October, and is much more " ' glutinous and nutritious than ordinary rice, or than the black *Béni* " ' of the Bengalies, also grown in Chittagong.' "

"Mr. Landale described this rice as getting quite glutinous when cooked, and mentioned that for this reason it is frequently steamed instead of being boiled in the ordinary manner. Besides being used as a food in the regular way, it is made into a sort of pudding, flavoured with scraped cocoanut. The rice becomes quite purple when cooked. Of the white rice, Mr. Landale said, this is also a *Béni* rice, this name being used for the glutinous kinds. It has the same characteristics as the black rice, and is grown by the same people and in the same manner, both requiring but little water and thus being varieties of Hill

* *Kew Bulletin*, 1887, December, p. 7; 1888, p. 266; and 1889, p. 283.

rice. *Béni* rice is considered very nourishing and also satisfying, and for some reason is often mixed with other kinds and not eaten by itself.

"There seems to be very little recorded regarding this rice, although a sample of each from Kyouk Phoo was presented to the Society over 60 years ago by Captain Warden, who wrote: *Black rice.*—The black rice is not procurable in any large quantities on the Arracan coasts; but is, I hear, more plentiful on the Martaban coast at Moulmein, Rangoon, &c., and is only used for sweetmeats, as I understand. *Béni Choul.*—This rice is not procurable in any quantities, and is merely used by the natives in their sweetmeats. It is capital for puddings, &c.

"Dr. Watt, in his lengthy article on rice in '*The Dictionary of the Economic Products of India*' makes three short allusions to the glutinous rice. He mentions it is known in China under the name of *No*, that the botanical divisions which have been adopted do not distinguish the scented and the glutinous rices from ordinary varieties. He adds: 'The peculiar glutinous rice of Burma has been well known 'for many years. In an early part of this article reference has been 'made to Rheede's botanical account of it under the name of *Oryza* '*glutinosa*. Ainslie speaks of it as never used as bread, but com- 'monly prepared as sweetmeat. There would seem, however, little or 'nothing to justify its botanical separation from many of the other 'forms of *O. sativa*; but it is noteworthy, in concluding these remarks, 'that it is not only recognised commercially, but by some writers as 'botanically distinct from the ordinary rices of Bengal.' . . . It will be seen that so far as the records on the subject go, the glutinous rice has been supposed not to be used as an ordinary food; but Mr. Landale, whose attention has been drawn to this, states from his personal knowledge, that this rice is a very popular food in Chittagong, and, in addition, it is used for making both rice beer and spirit, the latter a very potent article."

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Professor CHURCH to ROYAL GARDENS, KEW.

Shelsley, Kew Gardens,
2nd August 1892.

MY DEAR MORRIS,

THE analysis of Burmese rice is completed. The results amply confirm the opinion entertained of its high dietetic value. I will send you the formal report in a day or two, but I may at once say that in flesh-forming substance, in oil, and in mineral matter this black rice shows a marked superiority over all samples of other varieties hitherto examined.

Yours, &c.
(Signed) A. H. CHURCH.

The sample of Burmese black rice submitted to analysis had been imperfectly "cleaned," no inconsiderable portion of the innermost layer of the dark integument remaining upon many of the grains. This layer contains the colouring matter which gives the dark appearance so characteristic of this kind of rice. This pigment proved to be identical with that to which the red colour of grapes, black currants, the florets of the crimson dahlia, the leaves of the copper beech, and of *Coleus Verschaffeltii*, and a great many other leaves, flowers, and fruits is due. It has been called by various names, such as oenolin, erythrophyll, colein, and anthocyan, and is represented by the chemical formula

$C_{20}H_{20}O_{10}$. When a few grains of black rice are covered with slightly acidulated spirits of wine, the pigment dissolves with a magnificent crimson colour.

One hundred grains of this sample of rice weighed 43 grains.

Composition (in 100 parts).

| — | Burmese Black Rice. | Other Indian Rices (average). |
|---|---|---|
| Water - - - - - | 13·2 | 12·8 |
| Albuminoids - - - - | 9·2 | 7·3 |
| Starch, with some sugar and gum - | 74·1 | 78·3 |
| Oil - - - - - | 2·2 | 0·6 |
| Fibre - - - - - | 0·6 | 0·4 |
| Ash - - - - - | 0·7 | 0·6 |
| Nutrient ratio - - - | 1 : 8·6 | 1 : 10·8 |
| Nutrient value - - - | 88·4 | 86·5 |

The most noticeable peculiarity of this rice is its unusual richness in albuminoids and in oil. Some of the most highly esteemed of the Japanese glutinous rices have indeed been found to contain from 1½ to 2 per cent. of oil, instead of the 0·4 or 0·5 per cent. commonly present in Carolina rice, but then they are comparatively poor in albuminoids. In the sample now under discussion it was found that the coagulable albuminoids, as determined by the phenol method, amounted to 8·5 per cent., a figure which is only 0·7 per cent. lower than the proportion recorded in the above analysis, and which still compares favourably with the average, namely, 7·3 per cent., present in other Indian rices. And it must be remembered that a similar reduction (say 0·6 per cent.) must be made in the latter figure, in order that a fair comparison between the two per-centages may be made. The numbers will then be—

True albuminoids in 100 parts of—

| | |
|---|---|
| Black Burmese rice - - - | 8·5 |
| Other Indian rices - - - | 6·7 |

One of the results of this richness in albuminoids is brought out on calculating the nutrient ratio of this Burmese rice, which is much nearer to that of a complete food than is the case with the common kinds of Indian rice. These latter are likewise rather poorer in phosphoric acid than the Burmese variety.

It is satisfactory to find that chemical analysis amply confirms the high dietetic value assigned to black rice by native opinion.

It should be mentioned that *all* the above statements relate to samples of *cleaned* rice.

A. H. C.

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## CCLXX.—MAURITIUS TEA.

(*Camellia theifera*, Griff.)

In the *Kew Bulletin* for 1888, p. 86, an account is given of the tea cultivation in course of being established or extended in Natal, Jamaica,

and Madagascar. In the *Kew Bulletin* for February 1887, p. 7, there are discussed the prospects of starting a tea industry in Mauritius. It was pointed out that there were already in that island about 25,000 tea plants, "and these should afford a ready means of testing the capabilities "of the soil and climate for a tea industry as well as the probable cost "of production."

We have now the pleasure of recording the fact that tea of very good quality has been grown in Mauritius, and a total weight of 865 pounds has been manufactured since January last. This, it is true, is only a small beginning, but if the island produced only sufficient tea for its own consumption it could very well support one or two small estates on hilly land in the interior, not required for other cultivation.

The following remarks on tea were written by Mr. John Horne, F.L.S., late Director of Gardens and Forests in a Report on the Agricultural Resources of Mauritius, published in 1886:—

"The tea shrub grows well in the higher lying parts of Mauritius. So far as the climate is concerned the growth of this shrub in most parts of the island that are situated at an elevation of more than 800 feet above the level of the sea is proved beyond a doubt. It has long since been introduced and planted at several places; but what has to be proved is the quality of the tea which the Mauritian grown leaf will produce. Then, whether the yield will be sufficient to give a profit on the expense of cultivating the shrub, picking its leaves, preparing them into tea, as well as other expenses incident to the cultivation of the shrub and the preparation of the leaves for the market, in such a condition as to compete favourably with teas from Ceylon, India, China, Java, &c.

"There is at present growing in the borders, &c. of the nursery gardens at Curepipe, a number of plants that would yield a sufficient quantity of leaves to test their quality when prepared into tea. So far then that test could be applied at once. The wants are appliances to cure the leaf, and a tea maker or curer. If these problems are satisfactorily solved there is not the least doubt that tea will take a place, perhaps of no small importance, among the products of the colony. The following is an extract from Report of the Botanic Gardens for 1882, viz.:—

"'A subject to which it is desirable to draw the attention of owners of land in the elevated parts of the country is the cultivation of tea. This shrub thrives admirably on the heights, and its cultivation if taken up in a systematic manner would be remunerative. In the year under review a supply of tea leaves for a trial to make tea was given to Mr. D. Picton Davis, land surveyor, who had considerable experience in the cultivation and making of tea in India. With no other appliances than a common pot, in which to dry the leaves, he made a passable tea. The sample which he gave me was tried by myself and several friends. Its fault was newness, and the tea tasted a little musty, from being imperfectly dried; still it was sufficient to show what could be done, with proper appliances and management. Large numbers of Indians are purchasing lands at some elevated portion of the island. Sugar-cane or maize they may not be able to cultivate profitably but the tea-shrub would grow well in these places; and a central tea curing establishment, would indeed be beneficial to this industry. The intelligent and practical manager of the Vacoa Sugar Estates Company, Mr. J. W. Shand-Hervey, promised to give the cultivation of the tea shrub and tea making a trial, on such a scale, that sound practical result favourable or not favourable might be obtained. However, Mr. Shand-Hervey has recently left for England, and this matter has been postponed, but not for ever, it is to be hoped.'

"The value of tea imported during 1884 was Rs. 34,502. The value of the quantity exported in the same year was Rs. 1,804. The value of the quantity consumed in the Colony was Rs. 32,698 for that year. The supplies came principally from England, India, Ceylon, Hong Kong, and Singapore. Several parties are now beginning to take an interest in tea cultivation, and it is to be hoped their endeavours will be crowned by success."

The next step in the establishment of a tea industry in Mauritius appears to have been taken by Sir John Pope Hennessy in 1886. In a letter addressed to the Secretary of State he gives the following particulars of the measures undertaken by him to secure supplies of seed and a competent person to start the curing of tea :—

SIR J. P. HENNESSY to EARL GRANVILLE.

Government House, Mauritius,
3rd August 1886.

MY LORD,

I HAVE the honour to report that the number of tea plants now growing in Mauritius amounts to about 25,000.

2. I enclose for your Lordship's information copies of letters I have addressed to the Governor of Madras and the Lieutenant Governor of Bengal, asking them to assist me in getting various seeds required for the various experimental plantations, and also to engage the services for this Government of two men well accustomed to the cultivation and curing of tea, and a man conversant with the curing of tobacco.

I have, &c.
(Signed) J. POPE HENNESSY.

The Right Hon. Earl Granville, K.G.,
&c. &c. &c

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An article on the cultivation of tea in Mauritius was published in the *Revue Agricole*, a local agricultural paper, for April 1887. Following this there appears to have been established a small plantation in the Government Experimental Farm at Curepipe, and a man with Ceylon experience in tea cultivation and curing was placed in charge of it. The more recent results are given in the following correspondence :—

SIR, Downing Street, 9th September 1892.

I AM directed by the Secretary of State for the Colonies to transmit to you for your information the accompanying copy of a despatch from the Acting Governor of Mauritius, enclosing reports upon the experimental tea industry of Mauritius.

I am, &c.
(Signed) R. H. MEADE.

The Director, Royal Gardens, Kew.

Government House, Mauritius,
8th August 1892.

MY LORD,

I HAVE the honour to transmit, for your Lordship's information, a copy of a letter which I have received from Mr. Regnard, chairman of the Experimental Plantations Committee, enclosing a report from Mr. Corson relative to the experiment which is being made in tea planting in the colony.

2. Your Lordship will observe from Mr. Corson's report that since the 1st of January 865 lbs. of tea have been manufactured, which is an encouraging result.

3. I also forward to your Lordship copy of a report and valuations made in Ceylon by Messrs. Somerville & Co. on the samples of Mauritius grown teas, which is also satisfactory.

4. The experiments in this direction, so far as they have gone, augur well for the future development of tea planting in this colony, and I will not fail to keep your Lordship informed of the progress made in extending this new industry.

5. It may interest your Lordship to know that during the recent hurricane these plantations did not suffer in the least.

I have, &c.
(Signed) H. E. H. Jerningham,
Administering the Government.

The Right Hon. Lord Knutsford, G.C.M.G.,
&c. &c. &c.

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The Mauritius Government Experimental Garden.

Dear Sir, Colombo, 5th April 1892.

Having examined and tasted the following teas, we now beg to hand you our report and valuations, as under, viz. :—

| Nos. | Samples Mark. | Description. | London Value. | Colombo equivalent at each. | Remarks. |
|---|---|---|---|---|---|
| 1 | — | Orange Pekoe - | 2*s.* | — | Blackish, well made very tippy broken Orange Pekoe leaf. *Liquor*, strong, dark, fine quality. |
| 2 | — | Broken Pekoe - No. 1 | 1*s.* 7*d.* | — | Blackish, well made and twisted Orange Pekoe leaf. *Liquor*, strong, dark, fine quality. |
| 3 | — | Broken Pekoe - No. 2 | 1*s.* 8*d.* 1*s.* 9*d.* | — | Blackish, well made, very tippy, leafy, broken Pekoe. *Liquor*, strong, dark, some flavour (quality fine). |
| 4 | — | Pekoe Souchong | 9*s.* | — | Blackish greyish, small choppy leaf, little flakey. *Liquor*, strong, dark, good quality. |

Infused leaf Nos. 1, 2, and 4 :—*Not bright enough.*

Infused leaf No. 3 :—Bright.

P.S.—The Orange Pekoe and broken Pekoes are very fine in appearance.

Yours faithfully,
(Signed) P. P. Somerville & Co.
D. Seale.

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REPORT ON THE GOVERNMENT EXPERIMENTAL FARM, CUREPIPE.

*Tea.*—The cyclone of the 29th ultimo did scarcely any damage to the tea fields. The leaves only of the large trees reserved for seed were blown about. As for the trees from which leaf is plucked they suffered still less, being much smaller, a flush or two will be lost; that is to say, there will be no plucking for the next 10 days; but after that I expect some heavy flushes, the wind having had the effect of a light pruning on the trees.

Of the young tea, now about two years old, the plants raised from cuttings suffered a little, and half a dozen plants were blown down; this is owing to the plants having no tap-roots. It would not be advisable to plant tea by cuttings.

*Buildings.*—A set of new lines were knocked down, and will cost Rs. 20 to put up again.

*Factory.*—Part of the thatched roof was carried away, and it will be necessary to remove the whole of it and replace it by an iron roof; cost about Rs. 120. At present I have repaired the damage as well as I could with thatch, &c., and as soon as carpenters can be procured at the ordinary rate I shall proceed with the work. At the same time the factory ought to be increased; it is far too small, and it is impossible to make good tea in it when there is a rush of leaf or the weather is wet. Leaf often heats, and I have to throw it away.

*Tea Manufacture.*—Since January 865 lbs. tea have been manufactured. Previous to that, there is in the large bin about 700 lbs. more; I cannot find the accounts.

*Clearing.*—I am clearing about six acres of land, and have reached the boundary (the wire lines); beyond this the Inspector of Forests at Curepipe has told me that I was not to touch.

(Signed) A. J. CORSON.

Curepipe, 6th May 1892.

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## CCLXXI.—POTATO DISEASE IN POONA.

The following correspondence has been received at Kew from the Secretary of State for India, on the subject of a disease in potatoes that has appeared in the Poona district, and in other localities in the Bombay Presidency. It is apparently quite distinct from the well-known potato disease induced by the attacks of a fungus (*Phytophthora infestans*). The Indian disease is in course of being investigated locally by Dr. Cunningham, F.R.S., and the results will be published later. In the meantime, Mr. George Massee, after reading the correspondence, agrees that "The disease indicated is evidently quite distinct from that "caused by *Phytophthora infestans*, but, judging from the account "given, closely resembles that caused by *Peronospora trichotoma* on "*Colocasia antiquorum* in Jamaica (*Journ. Linn. Soc.*, vol. xxiv., "p. 45." "If," he continues, "the sclerotia are formed in the substance "of the haulms, the removal of these from the ground would be as "effective, and more economical, than treating the soil as suggested."

The treatment of the soil on a large scale with a solution of copper sulphate (an ingredient in the well-known *Bouillie Bordelaise*) is likely to render it injurious to plant life, and especially as in some experiments lately undertaken in this country, there is an excess of copper salt left undecomposed in the soil. The result would vary,

according to Dr. Russell, in proportion as the salt is naturally calcareous, or purely silicious. In the latter case a deficiency of basic material would very likely bring about an excess of copper sulphate as a residue. There is also another question involved, and that is, that the use of acid copper solutions might act injuriously by destroying the nitrifying organisms in the soil.

If the plants only are treated with the copper solutions and the haulms and all rotted or diseased tubers are immediately removed from the land or burned at the time of cropping, such precautions might in themselves be sufficient to keep the disease in check. It would appear to be essential, however, that the present system of continuous cultivation of potatoes on the same land, year after year, should be discontinued. The steps taken to procure fresh supplies of good seed potatoes for planting are very important, and deserve to be encouraged in every way.

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## India Office to Royal Gardens, Kew.

India Office, Whitehall, S.W.,
17th September 1892.

Sir,

I am directed by the Secretary of State for India to forward herewith for your information, and publication in the *Kew Bulletin*, if considered advisable, a note by the Director of Land Records and Agriculture, Bombay, on the potato disease prevalent in the Poona district and elsewhere in that Presidency.

I am, &c.
(Signed) Horace Walpole.

The Director,
Royal Gardens, Kew.

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## Note on the Potato Disease prevalent in the Poona District and elsewhere.

In January last year a potato disease was brought to notice affecting the crop of the Khed and Junnar Tálukas, which largely supply the Poona and Bombay markets. It has since been found elsewhere in the Poona district, in Gujarat, and at Mahábaleshvar. It seems to have made its first appearance some three or four years ago, and it now occupies the chief potato grounds of the Presidency, causing heavy loss to cultivators, and a marked deterioration of quality in the potatoes sold for consumption.

The cultivators call this the "bángdi" disease, owing to the appearance of a dark ring easily visible in the substance of the tuber on section. Unsound and (apparently) sound potatoes are found in the same field, but the whole crop is in such cases probably affected. The first outward symptom is a withering of the green top, with arrest of the growth of the tuber. The diseased crop when dug is found to be greatly undersized throughout; many tubers are rotten and putrid; others show, by a small livid spot, where putrescence is about to set in. The whole potatoes are eatable when fresh, but rot away in storage.

2. During the past season, potatoes were imported from Mahábaleshvar, Saharanpur, Bangalore, Ootacamund,* and England, and were

* The disease has made its appearance in the Neilgherries. The seed imported was of a kidney potato, which at Ootacamund had been found best to withstand infection.

distributed to cultivators as seed in the hope that the sets from hardy stocks and from a distant soil might prove sufficiently robust to resist the infection, at least for some years. Mr. Mollison, the Superintendent of Farms, gave special attention to this experiment, and also tried the effect of applying solutions of sulphate of iron and of sulphate of copper to the affected fields; both experiments have failed. The worst plots were naturally those sown with the Mahábaleshvar seed, it not being known before that the hill district was already infected. The only sound crops found were those grown in the compound of the Mamlatdar's office at Khed, and in a garden hitherto used for "pan" (Piper betel). Neither of these two grounds had been under potato for some years certainly. All the other crops exhibited the characteristic ring.

3. Concurrently with these experiments a field was sown at the Khandesh Government farm with Poona seed, which appeared to be perfectly sound. Some of the seed potatoes were kept for further examination. Khandesh is not a potato district, and the land sown had never been under potato before. The crop was diseased throughout, proving that the seed was infected, though, when sown, the signs of disease were not distinguishable by the eye. On examination of the seed potatoes which had been stored the characteristic ring and a mottled unhealthy condition of the flesh were plainly apparent. Mr. Mollison found in the diseased crop indications of a fungus which appeared to attack the green stem first.

4. At the Poona farm four varieties of English potatoes received from Messrs. Sutton and Sons were planted side by side with Poona potatoes, selected for apparent soundness, on land not before used for this crop. The English seed of all varieties produced a sound and healthy crop and has been reserved as seed for further experiment. The local potatoes were diseased, but not greatly so, and were marketable. In this experiment all the potatoes were planted in ridge-rows as in England, the irrigation water being directed along the furrows.

5. A small quantity of true seed (from inflorescence) was obtained from France, and was also tried at this farm. The object of growing from the true seed is to establish a strong and natural stock, such as in Europe is systematically resorted to when the artificial strains have shown a tendency to weakness. This experiment is being continued, but conclusions cannot be drawn at this early stage.

6. Specimens of plants in various stages of sickness have been submitted by Mr. Mollison to Dr. Cunningham, the Special Assistant to the Sanitary Commissioner with the Government of India, who has undertaken a scientific investigation of the blight. I have Dr. Cunningham's permission to quote his provisional conclusions, but it must be clearly understood that the subject is still under inquiry by him, as well as by this department, and that any opinions expressed are subject to modifications after more complete investigation. Dr. Cunningham writes: "You are quite right in distinguishing this affection from common "potato blight, for there are no signs of *Phytophthora* about the plants. "So far as I can ascertain, it is essentially due to an invasion of the "vascular bundles of the base of the haulm by fungal mycelium, which "is to be found in all the elements of the bundles, and in special "abundance in the larger vessels, which are in many places absolutely "plugged by dense sclerotial masses of filaments. With such an "invasion of the water-leading system it is of course only natural that "withering of the host should occur. The method of irrigation which "you say is employed must afford special facilities of access to the "parasite invading the submerged basis of the haulms, and the con-

" tinuous cultivation of crops from year to year in the same areas must " tend to keep up a continuous supply of the parasite, the sclerotial " masses of mycelium within the vessels being very well adapted to " survive prolonged period of dormancy, with a capacity for renewed " active growth on the recurrence of favourable conditions."

7. Mr. Mollison drew attention to the fact that the disease shows itself only on the plant approaching maturity, when the fibro-vascular bundles of the stem are well developed. At first the flesh of the tuber shows little or no sign of disturbance, but at a point about an inch below the soil-surface a brown stain makes its appearance in the substance of the haulm, and, this extending above and below, the disease rapidly declares itself. The sudden wilting of the apparently healthy green plant, often within 24 hours, is a marked and peculiar symptom. In a further communication Dr. Cunningham says:—" None of the specimens of the " blight which I have seen show any trace of spore formation, but they " do most distinctly show the formation of sclerotial masses of mycelium " within the cavities of the vessels. These are very probably the source " of propagation, as similar bodies certainly are in the case of some " other vegetable blights; and, if so, the delay in the appearance of the " disease is readily accounted for, as sclerotia frequently require a con- " siderable time to become roused from their dormant condition and " give origin to new mycelium. They in fact play the part of resting " spores, and, like them, are not always at once prepared to germinate. " The brownish tinge in the vascular bundles is in the haulm clearly " associated with the invasion of the mycelium. . . . . It is, as " you suggest, very probable that it is only in the upper layers of soil " that the sclerotia find all the conditions favouring their becoming " active. There appears to be little tendency to spread of the mycelium " downwards along the bundles of the roots, as compared to that which " it has to pass upwards along those of the haulm, and I have as yet " been unable to find any traces of it in the tubers, even where most " highly affected, as indicated by the blackening of the vascular bundles " and surrounding areas of parenchyma."

8. The scientific inquiry, Dr. Cunningham goes on to say, can only be concluded by means of experiments on infection of living plants, and these cannot be carried out before next cold weather. Meanwhile every effort must be made to discover a practical remedy for a disease which threatens to destroy one of the most valuable garden crops of the country. So far it has been shown :—

(i.) That the disease is not the European potato blight. From this it differs in the absence of the black fungous spots on the leaves and of the characteristic odour; and it differs also in not being amenable, when the crop is in the ground, to treatment by the sulphate of iron and copper solutions.

(ii.) That diagnostic symptoms may be found, before the characteristic ring of tuber is apparent, in the sudden wilting of the green top, and in the antecedent brown discoloration of the fibro vascular bundles of the haulm discoverable on section.

(iii.) That the disease germ harbours in the soil, and will infect all stocks however robust.

9. The origin of the pest is probably to be found in exhaustion of the soil and of the stock owing to over cultivation. The crop is so profitable that it is grown year after year on the same land, and the unwillingness of the cultivator to exchange it for less valuable produce, even when disease is rife, forms one of the chief difficulties to be met. A rest from potato for three or four years would probably cleanse infected land.

10. This note is published in the hope that, attention being drawn to the subject, other investigators may assist in the inquiry, so that repressive measures may be introduced without loss of time. The further experiments to be made by this department next season will be carried out mainly on the following lines, but others will doubtless suggest themselves :—

(i.) By application of the solutions of iron and copper to the field before sowing. Dr. Cunningham's researches have afforded a clue to the failure of this method when applied to the growing crop. Used in this way, it succeeds with the ordinary blight, and in the absence of microscopical investigation, it was puzzling to find that it had absolutely no effect on this disease, but, as the fungus is found to establish itself at once in the deep tissues, it is clear that external applications to the plant can be of no use. The fungal germs can, however, be attacked while harbouring in the soil, and a free treatment with the solutions ought to succeed. If in infected soil so treated, and sown with healthy seed, an untainted crop can be produced, a considerable step in advance will have been made.

(ii.) By improved cultivation. The method adopted at the Poona, farm, of growing the potatoes on ridges as in Europe, promises to afford considerable protection. There is little doubt that a saturated surface soil is favourable to the disease, and this it gets in perfection by the native method of growing potatoes on the flat. Mr. Mollison placed his ridges about 24 feet apart, with a foot between sets, and the irrigation water being run in the furrows, the soil was kept continuously moist, without ever being in the condition of a quagmire, as under the native system of flooding. The potatoes so grown were of fine quality and flavour, and free from the waxiness common to the Indian grown tuber. This, and the fact that none of the Indian potatoes produce seed-plums, looks as if a faulty method of cultivation may have caused degeneration and consequent susceptibility to disease in all the acclimatised stocks. The ridge system, in any case, deserves to be fully tried.

11. I append a few instructions as to the solutions referred to in the preceding paragraph.

(Signed) E. L Cappel,
Director, Land Records and
Agriculture, Bombay.

Poona, 11th June 1892.

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Copper sulphate solution with quicklime ("Bouillie Bordelaise") for 1 acre :—

45 lbs. sulphate of copper.
22½ lbs. quicklime.
220 gallons of water (2,200 lbs.).

The sulphate should be dissolved by hanging it in a coarse cloth or basket in water contained in a wooden vessel. Hot water acts more quickly. The quicklime is slaked in a separate tank and then stirred into a fine gruel with added water. This should be passed through a sieve into the solution, well stirred, and the remaining water added.

Iron solution with quicklime is made in the same proportions, substituting the iron for the copper salt. It is much cheaper, but its value

has not been definitely proved. The "Bouillie Bordelaise" was proved to be specific for the European blight by an exhaustive series of experiments in England and on the Continent, and the recipe is given as published by the Royal Agricultural Society. As the quantities were intended for spray application to the plant surface, probably more will be required for the disinfection of the soil, and a double quantity of the copper solution might be tried ; in the case of the iron solution even more may probably be applied without danger to the crop.

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## CCLXXII.—BRITISH NORTH BORNEO.

The following account of the progress of planting industries in this territory is taken from Mr. Consular Agent Pryer's Report, published by the Foreign Office [1892, Annual Series, No. 1,111].

"To turn to other planting operations. There is now hope that the real capabilities of the country will at last receive some attention. A coffee company started in London in the early part of the year has commenced work in Malluda Bay, and another company also started in London is testing the capabilities of the soil and climate in the neighbourhood of Sandakan for the cultivation of sugar-cane, Manila hemp, Liberian coffee, india-rubber creeper, cotton, and other things."

"Manila hemp is the fibre of the stem of a sort of banana, *Musa textilis*, which hitherto has been grown only in the Philippine Islands, where it is a source of great wealth to the growers, the Government, and all concerned, and is the means of affording freight to a large number of vessels. The soil and climate of North Borneo have also been proved, owing to a series of experiments conducted during several years past, to be particularly favourable to the proper growth of the plant ; satisfactory samples have been sent home, and the cultivation is now being considerably extended. Owing to the heavy taxes, &c. in the Philippines, it is claimed that North Borneo can put its hemp on board the export ship at a lower price than the Philippines can, and the first steps of North Borneo to rival the Phillipines in this production are being watched with much interest, as once started this industry may become of very large proportions in the future."

"Gambier, another thing whose growth also is entirely confined to this part of the world, is now being tried, the Government having started a small experimental garden at the back of Sandakan ; the plants at the end of the year were four months old and as large as those in the Straits Settlements at six months. This promise continues at the time of writing, and the Chinese in charge say they will be able to commence boiling two or three months earlier than in Singapore."

At the present time Gambier is almost exclusively a monopoly of the Straits Settlements. An account of its production is given in the *Kew Bulletin* for 1889, pp. 247–53. The following further information as to the progress of this staple in continuation of that given in the *Kew Bulletin*, 1892, p. 76, is taken from the *British North Borneo Herald* for July 1, 1892:—

"The Government gambier garden beyond Mengkaleenow is coming on very well. Boiling could be commenced at once, two or three months sooner from the time of planting (last September) than it is usually attempted in Singapore; but as the number of plants is so few it is thought better to wait for a month or two more."

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## CCLXXIII.—ALLOUYA TUBERS.

(*Calathea Allouya*, Lindl.)

In March 1891 there were received from Mr. J. H. Hart, F.L.S., Superintendent of the Royal Botanic Gardens, Trinidad, tubers of a *Scitamineæ*, which were known in the island as "Topee Tamboo" and used as an article of food. "The small tubers are the edible parts. "They are boiled and eaten like the ordinary potato, with butter and "salt. They have an agreeable nutty flavour and are much liked." In the absence of leaves and flowers these tubers were supposed at first to belong to some species of *Kæmpferia*. The tubers of *Kæmpferia rotunda* are of an oblong shape and nearly an inch in diameter, but they have a hot ginger-like taste which would prevent their general use as a substitute for potatoes. Similar tubers were also known at Dominica, according to Dr. H. A. A. Nicholls, F.L.S., under the name of "Tokkee Tambo" These local names it was noticed were evidently only a corruption of *Topinambour*, the French for the Jerusalem Artichoke *Helianthus tuberosus*. It was therefore impossible to trace the history of the plant from them. Quite recently Mr. Hart was enabled to forward to Kew good specimens of leaves and flowers and no difficulty was then experienced in identifying the plant with a well-known West Indian species of *Scitamineæ* that had yielded food in Carib times. It was known to the Carib people as Allouya, and the aboriginal appellation has been retained in the scientific name now borne by the plant.—

*Calathea Allouya*, Lindl. Griseb. *Flora Brit. West India Islands* (1864), p. 604. The root usually consists of a large ovate bulb, and to this several globose or ovate stalked tubers of various sizes are loosely attached by strong fibres. The smaller tubers are the parts usually eaten. The leaves are of a pale green colour, somewhat papery in texture, and placed on long petioles. They are ovate lanceolate, inæquilateral and strongly nerved. The scape or flowering stalk issues from the sheath of a floral leaf near the base; it is much shorter than the leaves, simple, and bears a capitate spike of flowers. The green imbricated bracts have a pale membranaceous margin. The flowers are pure white, and are followed by a three-celled capsule with three seeds.

One of the earliest accounts of this interesting plant is given in Plumier's Manuscript, vol. v. tab. 35, where it is described as "Alloya "foliis cannacori radicibus tuberosis."

Aublet in *Hist. Pl. Guian.* Fr., Vol. 1, p. 3, refers to it as *Maranta Allouya*, "des racines sont garnies de tubercules plus on moins gros "qui sont bons à manger cuits sous la cendré." He describes minutely the locality in French Guiana where the plants were found by him —"On trouve cette plante dans une forêt marécageuse qu'on tra-"verse en allant de l'habitation de Madame de Gourgue á l'abattis "du Roi."

Descourtilz figures the plant in *Flore Medicale des Antilles*, t. 26. He calls it a Curcuma with tuberous roots, and states the latter possess stomachic and anti-scorbutic properties. In his account of the plant and in the references he makes to Tussac and Labat he has evidently confounded it with the arrow-root plant (*Maranta arundinacea*). There is an excellent figure with description in Roscoe's *Monandrian Plants*, tab. 38, under the name of *Phrynium Allouya*. The figure was taken from a plant that had flowered in the Botanic Gardens at Liverpool. "This had been brought from the island of St. Vincent by "Mr. C. C. Parker, who found it flowering there in August 1824 at a "place called Belair."

It is evident that the plant has a fairly wide distribution in tropical America. It is found, according to specimens, in the Kew Herbarium, in Porto Rico (*Sintenis*), Dominica (*Imray*), Martinique (*Hahn*), and St. Vincent (*Anderson*). It is also known in San Domingo and Hayti, and extends southwards to Trinidad and Guiana. It does not appear to have been found hitherto either in Jamaica or Cuba.

When the tubers were received from Trinidad in 1891 they were brought before the scientific committee of the Royal Horticultural Society, and the following record appears in the *Journal* of the Society, vol. xiii., p. lix. :—" Mr. Morris exhibited specimens of tuberous roots " [supposed to be] produced by a species of *Kæmpferia* at Trinidad, and " used as food under the name of 'Toppee Tambo.' Mr. J. H. Hart, " F.L.S., the sender of the specimens, stated that the small tubers are " preferred, and these are boiled and eaten like a potato with salt and " butter. They have an agreeable nutty flavour, and are much liked " by the people. Similar tuberous roots are used at Dominica under " the name of 'Tokkee Tambo.' Mr. Morris added that this was an " interesting record of the use of the tubers of a Scitamineous plant for " purposes of food, and he suggested that they might be chemically " investigated. Professor Church was good enough to undertake an " examination of the specimens and report the results at a subsequent " meeting."

In the same *Journal*, p. cix., it is further stated " Professor Church " had examined the tuberous roots exhibited at a previous meeting by " Mr. Morris, which are used as food in Trinidad and Dominica. He " found that they contained very little starch, but a relatively large " amount of gummy matter, which possessed a strong left-handed rota- " tion, being apparently one of the lævulose group. He remarked that " it rapidly absorbed iodine, which became quite colourless, so that it " was difficult to detect the starch unless a considerable quantity of " iodine was present. These roots, therefore, would seem to have a " composition closely resembling the tubers of *Stachys tuberifera*," [a new vegetable lately introduced into this country].

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## CCLXXIV.—MISCELLANEOUS NOTES.

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MR. J. BURTT DAVY, Office Assistant, has resigned his appointment in the Royal Gardens, owing to ill-health.

DR. H. DUKINFIELD SCOTT, F.L.S., late Assistant Professor of Botany at the Royal College of Science and Royal School of Mines, South Kensington, has been appointed Honorary Keeper of the JODRELL LABORATORY at the Royal Gardens. This laboratory was built in 1876 through the munificence of T. J. Phillips Jodrell, Esquire, M.A., for the purpose of investigations on the material afforded by the living collections maintained in the Royal Gardens.

Numerous distinguished workers have used it during the last 16 years, and their researches have proved of great interest and importance. They have been printed in the publications of the Royal Society and elsewhere. The occupation of the Jodrell Laboratory has, however, not been continuous, and it has long been felt that the development of its utility would require the constant supervision of a permanent official so as to bring its work and administration into line with that of other branches of the establishment. Under Dr. Scott's charge, admission will be granted, as in the case of the Herbarium, to persons qualified to conduct original researches independently on material provided by the living collections. It will be no part of the Keeper's duty to give instruction to beginners or to afford advice and assistance to inexperienced workers. His aid in making use of the resources of the laboratory will be, however, always at the disposal of those who by previous training are capable of employing them to useful purpose.

The collection of Hardy Herbaceous Plants at Kew, an exceptionally rich one, is accommodated mainly in the formal beds in the Herbaceous Ground and in the Rockery, where collective interest rather than effect is aimed at. Many of the larger and showier species however require a bolder arrangement and more space than would be afforded in the Herbaceous Ground, and to provide this a large border, previously planted with mixed shrubs, was cleared, trenched, heavily manured, and planted in the spring with large flowered herbaceous perennials and annuals. The border, which is on the west side of the T. Range, is 350 feet long and 20 feet wide, and from the end of June till the end of September it has been a great attraction to visitors. The plants grown in it are perennial Sunflowers, Dahlias, Phloxes, Hollyhocks, Gladioli, Sweet Peas, Rudbeckias, Asters, Pentstemons, Stocks, Poppies, Pœonies, Foxgloves, and a large selection of other plants. Each kind is represented by a large bold mass. A few ornamental flowering shrubs such as Roses, Spiræas, Genistas, and also a few evergreens for winter effect are mixed with the herbaceous plants.

Aristolochia gigas var. Sturtevantii. This plant has bloomed freely in several of the tropical houses, particularly in the Water Lily House, where its large remarkable flowers hang very effectively from the roof. Kew obtained the plant originally from Mr. E. D. Sturtevant, New Jersey, who procured it from Guatemala in 1888. Its flowers are about 18 inches wide, 22 inches long, with a tail 42 inches long, their colour being creamy yellow and deep maroon purple. The adoption of Lindley's name *A. Gigas* for the type was explained by Mr. W. B. Hemsley, F.R.S., in the *Gardeners' Chronicle*, 1891, p. 552, where a figure of the variety is also given, and *Garden and Forest*, 1891, iv., p. 546.

Stevensonia grandifolia. A large specimen, probably the largest in Europe of this rare palm, and which has long been a feature in the Palm House at Kew, is now flowering for the first time. It is a native of the Seychelles, where it was discovered by Duncan, who sent three small plants of it to Kew in 1855, one of which was soon afterwards

stolen. Probably the specimen now flowering is one of the other two, although in J. Smith's Kew Records it is stated that "four months after "my retirement, in May 1864, I learned that these two rare palms were "dead." The genus is monotypic and endemic in the Seychelles, where it grows to a height of 40 to 50 feet. The Kew specimen is 30 feet high, and has a slender spineless stem. The leaves are cuneate, obovate, bifid, laciniated, 7 feet long and 5 feet wide, green, spotted with rusty red. The inflorescence is an erect branched panicle 3 feet long, clothed with yellow flowers. A figure of the plant has been prepared for publication in the *Botanical Magazine.*

Bromelia fastuosa, Lindl. This species was described and well figured by Lindley in his Collectanea in 1821 from a plant flowered by Aylmer B. Lambert, Esq., at Boyton, Wilts. The same species was named *B. antiacantha* by Bertoloni, *B. Sceptrum* by Fenzl, and *B. commeliana* by De Vriese. It is now widely spread in cultivation, and may be recognised by its bright-red, sword-shaped inner leaves, lax panicle, and especially by its petals, which are more protruded beyond the calyx-segments than in any other species. All the known species of this genus (about nine in number) resemble one another closely in the leaves. We have flowered at Kew this year this plant, as also a plant which we have had since 1872, under the name of *Hechtia longifolia,* (*see* Baker's Handbook of Bromeliaceæ, page 140). This latter proves to be a form of this same species.

The fine collection of Australian timbers in Museum No. 3 has recently been enriched by the receipt from the Technological Museum, Sydney, of a series of twenty-one specimens. These have all been authentically named in Australia from botanical specimens gathered from the actual trees themselves. The care thus exercised in obtaining their correct names makes them extremely valuable. It is too well known that the exhibits brought together at International Exhibitions have often been far from correctly named, the sections being often hurriedly cut, and the numbers, it may be, lost by the constant shifting of position, damp, or other causes. In consequence, many fine and otherwise valuable collections of woods have become quite worthless. It is with the view of making the Kew Collection absolutely trustworthy in regard to scientific nomenclature that Mr. J. H. Maiden, F.L.S., of the Sydney Technological Museum, has kindly undertaken to send from time to time samples of the woods of that colony whose identification can be relied upon. These will take the place of other specimens in the Timber Museum whose determination from one cause or other is open to doubt.

Amongst the numerous Oil Seeds that are constantly being received at Kew, for the purpose of naming, from Liverpool brokers and seed crushers were some that made their first appearance at Liverpool from the West Coast of Africa in February 1891. They appear to have

attracted a considerable amount of attention, judging from the fact that they were received at Kew from several different brokers about the same time, and a month later, in March 1891, samples were also received from Germany. Quite recently the same seeds have again appeared, having been sent to Kew by a seed-crushing firm at East Greenwich. The interest attached to them from a commercial point of view is probably due to the quantity of oil their kernels seem to contain, rather than to its quality or properties, for up to the present these appear not to have been tested, they may, however, become an important source both of oil and oil-cake, for though nothing definitely is known as to the plant producing them, inasmuch as no other material than the fruits themselves, without the fleshy coverings, have been received at Kew, it is clear from these alone that the plant belongs to the natural order *Olacineæ*, and probably to the genus *Heisteria*. The fruits as received are hard and woody, requiring some force to break them; they are ovate in form, about 1 inch long, and ¾ inch in diameter, of a dull earthy brown colour, marked by irregular longitudinal striations, the inside being filled with a whitish, fleshy, and very oleaginous kernel. From the fact that the plants constituting this order are free from any poisonous or deleterious properties, and that the fruits of some of the species are edible, it may be inferred that this new oil seed may prove of some commercial value. No locality has been given whence the seeds have been obtained, the only information on that head being, as before stated, that they were imported from the West Coast of Africa.

Through Dr. Bataline, the successor of Dr. Regel in the Directorship of the Imperial Botanic Garden of St. Petersburgh, Kew has received a further consignment of dried PLANTS, comprising about 1,200 species. Specially valuable amongst them are many novelties collected by Russian explorers in CENTRAL ASIA. It also includes a small collection from Hayti, whence we have very few plants in the Kew Herbarium.

Our rapidly increasing LIBRARY of scientific serials has been augmented by an almost complete set of the *Transactions of the Academy of Science of St. Louis*. It was a gift from the Academy, obtained through the kind offices of Dr. N. L. Britton of Columbia College, New York.

From Dr. G. King, Superintendent of the Royal Botanic Garden, Calcutta, we have received a valuable collection of about 100 sheets of dried specimens of PALMS, chiefly from the Malay peninsula and islands; and about 350 sheets of ANONACEÆ. The latter include types of nearly all the numerous species described by Dr. King in the fourth part of his "*Materials for a Flora of the Malay Peninsula.*" Out of the 25 Indian genera of *Anonaceæ*, 20 are represented by new species, varying in number from one in nine different genera to 17 in *Polyalthia*. We are also indebted to Dr. King, who has been working at Kew this summer and autumn, for the determination of our unnamed specimens of Indian Anonaceæ and several other natural orders, on which he is just now engaged.

Mr. J. Buchanan, C.M.G., Acting Consul in NYASALAND, has presented the Kew establishment with the first set of a large collection of DRIED PLANTS made in that region in return for the approximate naming of the same. The collection contains probably at least 500 species, each represented by several specimens; but until the collection is worked out it is impossible to do more than make a very rough guess at the number of species.

The number of species of PLANTS collected by Dr. G. D. Haviland in the district of SARAWAK, BORNEO, has been increased by two further collections to about 1,000. These two sets almost surpass the first one in interest. They consist almost entirely of species not contained in the first lot, and many of them are doubtless new. Amongst the more valuable additions we may mention a *Magnolia*, a genus not previously recorded from Borneo; *Baphia*, the genus previously known only from tropical Africa and Madagascar; *Plœsiantha*, described by Sir Joseph Hooker from very imperfect material from the district of Brunei; *Gonyanera*, *Praravinia*, *Rigiolepis*, *Hexatheca*, each only previously known from a single species found either in Sumatra or in Borneo; *Gonystylus*, represented by three different species, &c. The lowland collection is particularly rich in *Anonaceæ*, *Rubiaceæ*, *Myrsineæ*, and *Euphorbiaceæ*. So far as the determinations have been carried at present, two genera seem to be quite new, one near *Torenia*, and the other near *Ardisia*.

A collection made by Dr. H. A. Haviland and Dr. G. D. Haviland on the KINI BALU is of equal interest. It consists of about 355 species of which 41 are cryptogams. Of the phanerogams about 180 were collected below 7,000 feet, 75 between 7,000 and 10,000 feet, and 70 above 10,000 feet, on the steep rocky slopes of the summit. As our knowledge of the flora of Kini Balu is limited to a few general notes by Low, Spencer St. John, and Burbidge, and a small number of species figured and described mostly by Sir Joseph Hooker in the *Transactions of the Linnean Society*, vol. xxiii., and in Hooker's *Icones Plantarum*, vol. ix., amounting altogether to 30, this collection is highly interesting and illustrates the vegetation of three distinct regions as indicated by Spencer St. John in the proceedings of the Geographical Society for 1862. The general character of the vegetation is distinctly Malayan. The prevailing orders from 2,000–7,000 feet are *Rubiaceæ*, *Melastomaceæ*, *Orchideæ*, *Myrsineæ*, and *Euphorbiaceæ*; from 7,000–10,000 feet, *Vacciniaceæ*, *Rubiaceæ*, *Myrsineæ*, *Ericaceæ*, and *Myrtaceæ*. Of the *Melastomaceæ* only two were collected as against 23 in the lower region. Here Conifers and *Quercus* first appear and Rhododendrons become numerous. Above 10,000 feet *Cyperaceæ*, *Orchideæ*, *Rosaceæ*, *Rubiaceæ*, *Vacciniaceæ*, and *Ericaceæ* predominate. *Coniferæ* are represented by *Phyllocladus hypophylla*, Hk. f., and two Podocarpi, the first reaching 12,000 feet. A dwarf oak, and probably a new genus of *Cornaceæ*, near *Alangium*, are common to this and the intermediate region. A few of the plants are identical with species found by Sir William MacGregor in the highlands of New Guinea, such as *Drimys piperita*,

Hk. f., *Potentilla leuconota*, D. Don, *Rhododendron Lowii*, Hk. f., *Drapetes ericoides*, Hk. f., and *Phyllocladus hypophylla*, Hk. f., whilst others are closely allied to species from New Guinea, or are representative of Australian types, as, for instance, a *Ranunculus*, a *Leptospermum*, a *Trachymene*, a *Coprosma*, a *Euphrasia*, and one or two grasses. Another foreign element in this highland flora is a *Photinia*, similar to *P. Delavayi* from South-west China. Apart from these few exceptions, the character of the flora, even of the highest part of Kini Balu, is also essentially Malayan.

Under the authority of the Government of Ceylon, Dr. Henry Trimen, F.R.S., Director of the Royal Botanical Gardens in that Colony, is engaged in preparing for publication a HANDBOOK TO THE FLORA OF CEYLON. The work will be illustrated by 100 coloured plates of the more interesting species. All the known species will be fully described, and much local information afforded with a view to render the book of use to residents in the island. The first part, accompanied by 25 plates, is expected to be ready by the beginning of 1893. The work will be published by Messrs. Dulau & Co., Soho Square, London.

It is a matter of regret to record that MR. JOHN HORNE, F.L.S., has been compelled, on account of ill-health, to resign the post of Director of Gardens and Forests at Mauritius. Mr. Horne has been connected with the Botanical Gardens at Mauritius for more than 30 years. He was trained at Kew, and his first appointment was as assistant gardener under the late Mr. James Duncan in 1861; he was appointed sub-director in 1866, and ultimately succeeded to the Directorship in 1877. Mr. Horne had charge both of the Botanical Gardens and of the Forests in Mauritius for 15 years, and he discharged the onerous duties of the dual posts with fidelity and success. The Mauritius Gardens, under his care, attained to a high degree of efficiency, and they were rendered of great service in promoting local industries in the island. Mr. Horne afforded valuable help in the production of the Flora of Mauritius and Seychelles by Mr. J. G. Baker, F.R.S. (published in 1877), and he contributed the principal supply of specimens illustrating the Flora of the Seychelles. In 1877, Mr. Horne visited Fiji (at the instance of its Government), and wrote "A year in Fiji" (published in 1881), a work dealing chiefly with the vegetable resources of the Colony.

In a letter addressed by Kew to the Colonial Office, dated the 15th March 1888, the following testimony was borne to the late Director's services:—

"Mr. Horne has most ably and industriously carried out his duties at Mauritius. The Mauritius Gardens are deservedly one of the most popular institutions in the island. They are annually visited by more than one-third of the inhabitants of Mauritius, and they have proved of signal service to the community by the introduction and distribution of new sugar-canes and other plants of a valuable character. "It is impos-" sible to over estimate the share taken by the Botanical Gardens in

" introducing hardy and productive varieties of sugar-canes to Mauritius " at a time when the sugar industry was imperilled by the attacks of " destructive insects and disease. Canes to the number of 130 varieties " 'were introduced by the gardens, propagated at them, and distributed " 'from them, not in a cane or so of each variety, but in quantities " 'of several thousand canes of each of the leading sorts to each planter.' " Of late years the Gardens have rendered additional services in " endeavouring to alleviate local depression by carrying on inquiries " with the view of establishing minor industries. Indeed, there would " appear to be no function attached to the Mauritius Botanic Gardens " which Mr. Horne has not endeavoured to discharge as fully as the " means at his disposal have allowed."

News has been received at Kew of the death from typhoid fever of Mr. G. Carstensen, Superintendent of the Victoria Municipal Gardens, Bombay. MR. CARSTENSEN was recommended for this post by Kew in 1886. He appears to have done excellent service in promoting horticultural matters in Bombay, and he has contributed several papers on gardening subjects to the *Journal of the Bombay Natural History Society*.

In a letter announcing Mr. Carstensen's death, he was described as popular and painstaking, and it was stated that he had greatly improved the garden under his charge, and he had contemplated extending the character and value of the collections so as to render them of greater scientific interest.

What little interest is being taken at present in extracting RAMIE FIBRE from *Boehmeria nivea* appears to be centred at Belfast. Numerous applications have been received at Kew for Ramie stems for experimental purposes, but owing to the unfavourable conditions of last winter the plants at Kew have yielded a poor crop of stems. It may be useful to state that investigators of Ramie in Ireland could very well obtain stems either from the Royal Botanical Gardens at Glasnevin, or from growers of the plant in the mild climate of the South of Ireland. Mr. F. W. Moore, Curator of the Glasnevin Gardens, writes that the plant is "quite hardy" with him, and he would be pleased to send specimens, as far as his resources allow, to those who apply to him for them.

A NEW VARIETY OF SUGAR-CANE is stated to have been discovered in the Upper Niger region of Central Africa. It is described as "a giant " variety possessing great saccharine richness, and capable of being " readily reproduced from seed which in this variety is well developed." Several inquiries have already been addressed to Kew in regard to this cane, and it may be well to state at once that there are grounds for

believing that the plant mentioned is not a sugar-cane at all, but the ordinary guinea corn or sorghum (*Sorghum vulgare*), which is widely distributed over Africa. This plant, it is well known, yields a useful syrup, and strenuous efforts are being made in the United States at the present time to extract a granulated sugar from it. Should the Niger plant prove to possess any special merits as a Sorghum we shall no doubt, hear more about it. It can have, however, little or no interest to the tropical sugar planter.

ROYAL GARDENS, KEW.

# BULLETIN

OF

# MISCELLANEOUS INFORMATION.

No. 71.] NOVEMBER. [1892.

## CCLXXV.—COFFEE CULTIVATION IN BRITISH HONDURAS.

In a Foreign Office Report [No. 255, Miscellaneous Series, 1892] on the coffee industry of Guatemala, a very interesting account is given by Mr. Roland Gosling of the present position and prospects of the very flourishing coffee industry which has been established in this Central American Republic. In the report it is stated that "the export of " coffee from Guatemala in 1891, amounted to 52,197,853 lbs., valued " roughly at about 2,185,397*l*., and this year's crop will, it is " confidently believed, be considerably in excess of that of 1891.

"Speaking generally, the climate of Guatemala is singularly healthy, " especially in the coffee zone, which varies in altitude from 1,500 feet " to 5,000 feet above sea level."

Very full information is given respecting the development of coffee cultivation of late years, the price of land, the circumstances connected with the supply of labour, and other questions likely to be of general interest. In conclusion Mr. Gosling mentions that "lands suitable for " the cultivation of coffee are still to be had at a moderate price, and it " is confidently believed that were labour sufficiently plentiful, three " or four times the amount of coffee now produced could be " grown.

"Over 20 per cent. of the owners of coffee estates are Germans, and " this, as has already been stated, is the case with nearly every branch " of industry in Guatemala.

"It is to be hoped that the time is not far distant when Englishmen " will turn their attention to this country and endeavour successfully to " compete with Germany."

This report is of importance at the present time if only as encouraging a hope, long entertained at Kew, that the rich coffee lands of the neighbouring colony of British Honduras, hitherto quite neglected, might be opened to a similarly prosperous coffee industry. The colony of British Honduras occupies the eastern or Atlantic slope of Central America; it closely adjoins Guatemala, from which it is divided by a frontier line, from Gracias à Dios to Garbutt's Falls, of about 85 miles. The high lands of British Honduras are

chiefly in the west or south.* They consist of a succession of rich valleys and forest clad hills from 600 to 4,000 feet in height. The chief industries in British Honduras have hitherto been mahogany and logwood cutting. Some sugar plantations have been carried on, and owing chiefly to the initiative and energy of a former Governor, Sir Frederick Palgrave Barlee, K.C.M.G., a moderate trade in fruit and other tropical productions has been established with the Southern States of America. The capabilities of the Colony are, however, practically undeveloped. There are grown at present on a comparatively small scale numerous plants, whose cultivation might be very largely extended. Indian corn or maize is the staple food of the Indian and Spanish population, and the returns are given as high as 56 bushels to the acre. Bananas and plantains are cultivated for export, and as regular steam communication with New Orlaans is maintained by means of a subsidy, the produce finds a ready market all the year round. Pine-apples, oranges, limes, and lemons are grown only in small quantities at present. The Caribs supply the local market with pine-apples.

Cocoa-nut planations have been largely extended on the rich lands of the sea board, and on the cays (or small islands) dotted along the coast. The export of cocoa-nuts for the last twelve years has shown a remarkable development. The total number exported in 1887 was 1,469,900, averaging from 12 to 30 dollars per 1,000. An experienced planter in British Honduras states that :—"For those who can wait for " a return on their money for eight years, I do not think that any more " profitable investment of their capital could be made in this colony " than by putting it into a cocoa-nut plantation." Cacao is apparently found wild in the forests of British Honduras. It flourishes on all the banana and plantain estates, and the quality of the produce when properly cured is excellent. The Central American India rubber tree (*Castilloa elastica*) is a native of British Honduras, and the produce is regularly exported. The tree is found on most of the Cohune ridges and especially near the banks and in the valleys bordering Mullin's River, Sittee River, and the Rio Grande. It is very abundant in some localities. The quantity of rubber shipped in 1887 was 23,967 pounds. The vanilla, sarsaparilla, numerous fibre plants, and very valuable hard-wood trees are found in the woods of the interior, but they have, as yet, scarcely received attention.

As regards the cultivation of Coffee the prospects just now are so satisfactory consequent upon very remunerative prices, that the high lands of British Honduras should certainly receive the attention they deserve. Under the guidance of Sir Alfred Moloney, the present Governor, there is little doubt that every encouragement would be given to the development of local industries. So far, only one coffee estate (San Filipe) has been started in the colony. In Mr. Morris' work on British Honduras he gives the following account of this estate in 1882 :—

"One of the chief inducements which drew me to the Cayo was to see a coffee estate about two miles beyond this place under charge of M. Vivenot. In company with the latter, whom I fortunately met at the Cayo, and M. Blanconeaux, we proceeded up the western branch of the Belize River, until we came to a deep, rich, well-sheltered valley surrounded by low wooded hills.

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*A Handbook of British Honduras, comprising historical, statistical, and general information concerning the Colony, compiled from official and other reliable sources, is published by William Blackwood and Sons, London and Edinburgh. A new edition is now in course of being issued.

"Here about 100 acres had been cleared and established in coffee under the shade of bananas, with corn as an intermediary crop. The coffee trees, about 30,000 in number, were from one to two years old from the time of planting. Seed had been obtained from Martinique, Trinidad, and Guatemala. As a whole the plantation was in a promising state; in some places the trees were overshaded by bananas, and consequently the plants were weak and "spindled." There is no doubt, also, that the ground had been somewhat impoverished by the excessive crop of corn (maize) which was then being taken off.

"Most of the trees about two years old were, however, bearing their first crop, and looked as if, even at this early age, some two or three hundredweights per acre would be yielded by them. The plantation was well laid out, with roads and intervals of 18 feet dividing the blocks. Naturally, being a pioneering effort, the best mode of procedure adapted to the district could not be obtained at once; and, again, the difficulty of obtaining labour had hampered the undertaking and increased the expense.

"I left the plantation, however, with a favourable impression respecting the possibility of growing good coffee in British Honduras, and I have no doubt that if coolie labour could be obtained, the whole of this western district would soon be dotted over with prosperous plantations. The cost of clearing and cleaning land ready for planting is put down at 6*l.* per acre; the labourers, at present, owing to the remoteness of the district, get from 42 to 50 cents per day."

In 1885 Mr. Edwin Forrest, a Ceylon planter, was employed for a short period in the colony, and he furnished the following account of the San Filipe Coffee Estate:—

### Extracts from a Report to the Belize Government on the San Filipe Coffee Estate.

The "San Filipe" Coffee Estate is distant from Belize about 65 miles in a straight line. It is situated in the Western District, near the Cayo, about five miles from the frontier of Guatemala. The approximate elevation is about 500 feet above sea-level. The thermometer ranges from 60° to 90° Fahr. No register of the rainfall has been kept on the estate, nor at the Cayo. It would be very useful to have a rain-gauge and journal kept on this estate, or in the district. The Government might start a rain-gauge at the police station at the Cayo. At the time of my visit (February 1885) about 100 acres of land were said to be opened (judging by number of the plants), but I think that the acreage will be more when surveyed. As regards roads a main road runs through the estate, with branch roads at right angles 25 feet apart. These roads are just now mostly grown over with bush and weeds.

In the nurseries there are about 300,000 healthy coffee plants ready for planting out. The buildings consist of a house of three rooms with stone walls and cement floor and a thatched roof of palm leaves. There are several outbuildings and sheds for animals. A good double disc pulper, by John Gordon & Co., London, is in use on the estate. The stock consists of 26 cows, 9 horse-kind, about 40 pigs; the grazing is good, as the above are all fed on nothing but natural grasses, except the pigs, which get plantains. The estate has produced about 120 bushels of parchment coffee and 1,000 barrels of maize this year. There are besides about 100,000 roots of bananas and plaintains, and the produce from these have been more than could be sold or consumed in

the district. In addition 2,000 cacao plants have been raised from seed and planted out, and 5,000 rubber plants, some mangoes, oranges, and limes. Some of the coffee trees have suffered from over bearing, and they are only three years old last November.

If rain falls every month of the year, as in Belize for 1884, there should be no necessity for shade for coffee, as I am sure the coffee has already suffered from over-shade from the bananas and plantains. . . . . at the south end of the estate on a flat piece of land, thick with grass and weeds, there is the finest piece of coffee on the whole property. This piece of coffee has a dark green appearance, and this spot is without shade.

San Filipe being near the frontier of Guatemala the labourers under advances are tempted to desert. Any attempt to recapture the deserters is futile. This is especially so with the class of men called "Spaniards." . . . . The Indians could easily be induced to work on estates with encouragement. If the coffee enterprise should extend in the western district a good road or railway will eventually be necessary as an outlet for the produce.

(Signed) EDWARD FORREST.

The latest information respecting coffee growing in British Honduras is contained in the following official correspondence which has been communicated to Kew:—

COLONIAL OFFICE to ROYAL GARDENS, KEW.

SIR, Downing Street, 21st September 1892.

I AM directed by the Marquess of Ripon to transmit to you a copy of a despatch from the Governor of British Honduras, and to inform you that the Crown Agents for the Colonies have been requested to send to you the box of samples of coffee therein referred to, for a report for which Lord Ripon will be obliged.

I am, &c.

The Director, (Signed) JOHN BRAMSTON.
Royal Gardens, Kew.

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Sir ALFRED MOLONEY to COLONIAL OFFICE.

MY LORD, Government House, Belize, 31st August 1892.

NOTWITHSTANDING the colony's contiguity to one of the principal coffee exporting countries of the world, the Republic of Guatemala, and the altitudes of its Hinterland, which if they do not rival at least compare favourably with the high country of Coban, now viewed, I understand, as the capital of the coffee garden of Guatemala, this Government is frequently asked whether British Honduras is fit for the cultivation of this commodity.

2. On the suitability of the soil and climate there can be no question whatever. In practical proof of such a conclusion I ventured to send to the care of the Crown Agents for the Colonies, on the 10th instant per S.S. "Antilles," a box of coffee as below, containing a sample of what is grown on the San Filipe estate, situate in the Cayo district at an elevation between 300 and 400 feet, and I beg to request that the Director of the Royal Gardens, Kew, be invited to favour this colony with an authoritative opinion on its quality and value.

3. In the consideration of such a cultural industry it must not be overlooked that the principal current difficulties which have to be locally faced and overcome, are insufficiency of labour and comparative inaccessibility, from want of roads whether cart or rail, to the areas best adapted to the growth of coffee. The question of means of communication has been settled in Guatemala sufficiently to have effected an extensive and valuable export in this commodity; it remains unsolved in this Colony, notwithstanding its age.

4. As to the extent coffee culture has reached in British Honduras the yield falls far short of local requirements, as can be readily gathered from the imports of the past five years.

5. *Coffea arabica* appears to be the species of the genus coffee generally grown in Central America, where it has become neutralised, as is the case in those of the West Indian Islands, in which the condition of labour has admitted of its cultivation.

6. On the lowlands of Guatemala *Coffea liberica* flourishes, where its harvesting is facilitated by the fact that its rich heavy berries when ripe do not drop to the ground, a condition of things that should not be lost sight of in this colony where labour is of such moment.

I have, &c.

(Signed) ALFRED MOLONEY,
Governor.

The Right Hon. Lord Knutsford, G.C.M.G.
&c. &c. &c.

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## ROYAL GARDENS, KEW, to COLONIAL OFFICE.

SIR, Royal Gardens, Kew, 10th October 1892.

I AM desired by Mr. Thiselton Dyer to acknowledge the receipt of your letter of the 21st September, forwarding a copy of a despatch from the Governor of British Honduras on the subject of samples of coffee grown and cured at San Filipe Estate in that Colony.

2. This coffee was received from the Crown Agents on the 20th September. Unfortunately it had been packed in a damp condition, or the package in which it was placed had been exposed to damp on board ship. In any case the condition in which the samples reached this country has had an unfavourable effect upon the report made by the brokers. The coffee was carefully dried at Kew and presented in as dry and attractive a condition as possible, but it was impossible to overcome the injury done to it previous to its arrival here.

3. In order to carry out the wishes of Sir Alfred Moloney the coffee was submitted for report and valuation to Messrs. Lewis and Peat, brokers of Mincing Lane. The circumstance of the dampness was fully explained to them beforehand, and their report is, on the whole, of an interesting and favourable character.

4. The fortunes of this pioneer coffee estate in British Honduras have been followed at Kew for many years. In 1879 the proposal to make a free grant of the land was supported by Kew; and in 1882, I had the opportunity of visiting the San Filipe Estate and reporting favourably upon its condition and prospects (*The Colony of British Honduras*, pp. 50, 51). In 1885 Mr. Edward Forrest, a Ceylon planter, visited the estate and prepared a detailed report upon it for the information of the Government. A copy of this report was afterwards communicated to Kew.

5. It is evident that coffee of very good quality could be grown in British Honduras, and there are large tracts of lands in the interior well

adapted for this cultivation. The principal drawbacks are the want of roads to these lands and a system of coolie or indentured labour to supplement the labour of the negroes and Indians, who are now for the most part engaged in mahogany and logwood cutting. At the present time, large fortunes are made in coffee planting in the neighbouring republic of Guatelama in Central America, and a flourishing coffee industry might also be established in British Honduras if the Government were able to open up the splendid lands in the interior and render them easily accessible from the coast by roads and light railways.

I have, &c.

Edward Wingfield, Esq., C.B., (Signed) D. Morris.
Colonial Office, S.W.

[Enclosure.]

Messrs. Lewis and Peat to Royal Gardens, Kew.

6, Mincing Lane, London, E.C.
6th October 1892.

Dear Sir,

We had this pleasure on the 4th instant, and beg to inform you that we have carefully examined the samples of *Coffee* you kindly sent us, and beg to report upon same as follows:—

Samples of Coffee forwarded by the Government of British Honduras.

*Sample A.*—Round bean, Caricollo, known here as pea-berry. The coffee is grey, mottled, and faded, and according to the sample, to-day's value is about 104*s.* per cwt. If less mixed with overgrown and defective berries, value would be about 2*s.* 4*d.* per cwt. over this.

*Sample B.*—"*Moca*," is also pea-berry, and on outward appearance may be a counterpart of the above, but if anything, the sample is less mixed and rather smaller. We presume there is no doubt the sample is correct. [Apparently selected pea-berry only.]

*Sample C.*—Ordinary flat middling size, and is also grey mottled and very faded and open make, value about 100*s.* or 101*s.* per cwt.

*Sample D.*—*Pergamimo* or parchment. The sample is good and clean, and has been well prepared. The coffee is colory and fresh, but somewhat discoloured and musty, owing to insufficient drying. If thoroughly well dried, and with the advantage of careful sizing, a parcel say of about 100 bags sent here to be cleaned, we think should bring the following prices:—For *bold size*, 108*s.*; *medium*, 104*s.*–105*s.*; *small*, 94*s.*–95*s.*; *triage*, 85*s.*–88*s.*; pea-berry, 110*s.*–112*s.* 6*d.* per cwt.

The samples have no doubt suffered owing to the extremely wet season which prevailed, and probably again in the transit, having been packed damp, necessitating further drying here, and materially altering the character and appearance of the coffee.

We should like to call your attention to the fact that many of the berries have been split and crushed by the pulper, which with more care in working might be avoided.

THE CALIFORNIA PRUNE.
(P. d'Agen.)

(1250. 9/92. 3612)

We have seen San Filipe estate coffee on the market and sold some in our sale last year, but only a small quantity.

The coffee is good of its kind, and with care and attention in preparation, curing, &c. should rank and compete favourably with Guatemala and other similar descriptions (grown on low lying ground).

Of course it does not compare with fine high grown Vera Paz, but would take its place with the bulk of Guatemala grades.

At the present time, owing to scarcity, a high range of values is ruling for all grades of mild coffee.

We are, &c.

D. Morris, Esq., F.L.S., (Signed) Lewis and Peat.
Royal Gardens, Kew.

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## CCLXXVI.—THE PRUNE INDUSTRY OF CALIFORNIA.

The production of dried prunes is an important industry in many parts of Europe. An account of the curing of the "French plum," a superior sort of prune, was communicated to Kew by Mr. M. W. Colchester-Wemyss, of Westbury Court, Westbury-on-Severn, and published in the *Kew Bulletin*, December, 1890, p. 263. There has lately been issued by the Foreign Office an interesting report on the prune industry of California, illustrated with coloured plates.* This was prepared by Mr. Vice-Consul Moore, of San Francisco, and taken from the Annual Report of the State Board of Horticulture of the State of California. The following extracts, with a reproduction of the plate of the Californian prune (Petite Prune d'Agen), are taken from the report as published by the Foreign Office:—

### Introduction into California.

It is to France that California is indebted for this healthful and profitable fruit. Louis Pellier, a French sailor, who had visited many parts of the world, arrived in San Francisco in 1849, and went to work in the mines in Trinity County. He did not succeed well there, and finally removed to San José early in the fifties. Here he established a nursery. He soon after induced his brother Pierre, whom he had left in France, to join him in California, and the two brothers worked the nursery together until the spring of 1856, when Pierre returned to France in order to marry a girl to whom he was engaged. Combining business with pleasure, he secured a large number of cuttings of prunes, grapes, and other fruits, which he brought back with him on his return. His bride and his brother Jean accompanied him, and, together with the box of precious cuttings, they made the voyage successfully, crossing the Isthmus of Panama and arriving in San Francisco in December 1856.

The prune cuttings were procured in the Ville Neuve d'Agen, from whence the common Californian prune derives its name of Petit Prune d'Agen.

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* Foreign Office, 1892, Miscellaneous Series. United States. Report (with plates) on the Prune Industry of California. London: Eyre & Spottiswoode. Price 11½*d*.

The importance of Pellier's experiment was not at first appreciated. A German nurseryman, named B. Kamp, procured some grafts from Pellier, and also worked for the introduction of the prune. He was one of the first to put out prune trees in orchard row. But comparatively little attention was paid to prune growing, as a speciality, for a quarter of a century after its introduction into the State.

## Growth of the Industry.

Probably the oldest orchard of any size in the State is the Bradley orchard, on Steven's Creek Road, about two miles out of San José. This was set out in 1870. The success of this led others to go into prune growing, and the O'Banion and Kent orchard, near Saratoga, was planted in 1878–9, and the Dr. Handy orchard of 100 acres, at Saratoga, followed in 1880–81; in 1881 the Buxton orchard, also at Saratoga, was planted, and prune growing and curing on a large scale became a fixed fact.

From that time the growth of the industry has been phenomenal. The prune industry has been practically the growth of the past decade, for within that period the planting of orchards, their cultivation, and the proper care of their product, have grown into a system. In the prune centre of Santa Clara county, which 10 years since produced not a pound of this fruit, it is now exported by the carload.

Santa Clara county was from the beginning the centre of the prune industry, and there was demonstrated the fact that prune growing would pay, that no extraordinary care was required in cultivation or mysterious skill in preparation. As soon as these facts were known other counties took up the pursuit, until now the prune is found in all except the highest mountain counties in the State. In 1870 there were but 19,059 prune trees in the State, while the Assessor's reports for 1886, which are probably 25 per cent. too low, give the number in the various counties that year at 1,077,841 trees.

## Distribution of the Prune.

The prune is a very hardy tree, and will thrive in a wide range of climate and soil and at various elevations. Wherever the greengage plum will grow, the prune can be grown. It will stand severe winter weather, and will grow where the thermometer touches zero. Its favourite habitat, however, is a temperate climate and a warm, generous soil. It can be grown in the Eastern States, but the short seasons there, the numerous pests, and the unfavourable conditions for drying which exists, prevent the East from ever entering the field as a competitor to California in the prune industry. The drying quality of the prune varies very greatly, owing to the varieties of soil in which it is grown. In some localities it will shrink in drying from four to one, while in others two-and-a-half pounds of green fruit will make one pound of dried. The fruit will also vary in different places in thickness and toughness of skin.

The prune is a gross feeder, and wants for its best development a rich and heavy soil with sufficient moisture to feed it. The foothills of Santa Clara county have long been regarded as especially favourable to the prune, but, as experiments in its growth have been made, other sections have been found that furnish all the required conditions, and while Santa Clara county is still, and probably always will be, the centre and most important section of this industry, it is not now the only prune county of the State.

### Methods of Cultivation.

The soil required for prunes depends largely upon the stock used, or rather, perhaps, the stock should be selected to suit the soil. A light, deep, sandy loam, not too moist and well drained, is adapted to peach stock, which does well on the sedimentary deposits of the higher valleys. Such soils are warm and light, and experience has proved that peach stock will do better here than on the heavy, clayey lands of the bottoms.

In the heavier soils plum stock does better than peach, and the Myrobalan or wild plum stock is the favourite. It is hardy, forms a good union with its graft, and does not sucker as other plum stock will.

The almond stock is a favourite with many growers who have a rocky subsoil, as it does well in such land, even better than the peach.

### Planting the Orchard.

In laying off the orchard it is desirable to have it symmetrical and to economise the land. A little thought and care displayed at the commencement will save much annoyance in after years, and it is no greater task to have the orchard neat in appearance and symmetrical in outline than to have it in a haphazard condition. There are three objects to be considered in laying out the orchards: symmetry of appearance, economy of space, and facility for future care. Of course, the first thing is to get the trees in straight rows, at equal distances apart, and everyone thinks he can accomplish this. But there are various methods of disposing of the straight row, and these methods all have their advocates and each one its advantages. The principal forms are the square, the quincunx, and the hexagonal or septuple. The methods most common in use are the square and the quincunx systems. The most generally adopted is the square system, as the orchard can be changed to quincunx after being planted, even after a number of years' growth, by the addition of a tree planted in the centre of each square.

The square system is the most approved. The orchard is laid off in lines crossing each other, with equal intervals of space, and a tree planted at each crossing of the lines. By this method, at 20 feet apart, 108 trees are planted to the acre.

### Varieties.

The principal varieties are the California (the Petite Prune d'Agen), the Bulgarian, the Fellenberg, the German, the Hungarian, and the Hungarian Date Prune, the Robe de Sergent, the Silver, and the Tragedy. Of these the first named is by far the most popular, and forms the true shipping prune of California.

### Propagation of the Prune.

The first prunes were grafted on plum stock, but this has grown into disfavour on account of the tendency of plums to throw out suckers; and other stocks, the peach, the apricot, and lastly the Myrobalan plum, have come into use.

There is an intimate relation between soil and stock. For light, sandy soil the peach stock is yet in great favour, and many growers prefer it over all others. Upon heavier soils it does not do so well as does the Myrobalan. For some time apricot stock was the favourite,

but it has now fallen into total disuse. Experience has taught fruit growers a severe lesson. The prune makes a very poor union with the apricot, and when the tree gets to be large enough to catch the wind it invariably breaks off at the joint of the two stocks. In one instance a fruit grower lost 1,000 trees in an orchard.

The Myrobalan, or cherry plum (*Prunus Myrobalana*) has of late come into great favour as a stock for the prune. It is claimed by some growers that the fruit on Myrobalan stock is smaller than on peach stock, but that its flesh is more solid and dries heavier. The influence of the root on the cured fruit is, however, still a mooted question.

The Myrobalan stock comes from France. It is a wild plum of great thriftiness, and is used very extensively in that country for budding stock of the prune. It grows readily from seed and cuttings, and is easily propagated. The seeds are generally sent to this coast in the middle of October, and then they are at once sprouted. Myrobalan of French origin is now the accepted plum stock for California. It has largely displaced the St. Julien and the Myrabelle, as well as the peach. Though described by some authorities as a dwarfing stock, it is found to be sufficiently free-growing in California to suit all purposes, and to form a good foundation for full standard trees. Its leaves are smaller and its shoots finer than the cherry plum tree, grown for its fruit in this State.

The prune is propagated by both budding and grafting. It is customary to bud the young stock first, as, if the bud does not take, it affords an opportunity to graft later in the season, thus giving the nurseryman two chances. The budding season extends from the middle of July to the end of August. The young trees are stripped of their leaves and twigs about 6 inches above the ground, at which place the bud is inserted. The grafting season is in January and February, at which time grafts are inserted in all the plants in which the buds have not taken. The grafting is done as near the surface of the soil as convenient, usually about 2 or 3 inches from the ground. [The whole process of budding and grafting is described at length in the present report, under Propagation of the prune.]

### Cultivation.

In the prune orchard, as in all others, careful cultivation pays. A double object is attained by keeping the surface well pulverised. First, the weeds, which draw heavily upon the vitality of the soil, which should be devoted to tree and fruit growth, are destroyed, and the fertilising qualities which they would extract from the land are left for the benefit of the growing fruit. Secondly, it prevents the rapid evaporation of moisture of the soil. the loose surface acting as a mulch, and on dry lands especially, renders the need of irrigation less frequent.

### Pruning.

The training of the young tree requires thought, care, and judgment. In the first three years of its life it is to assume the form which it is to retain during its whole existence. Here, again, the individual judgment must be exercised, and conditions of soil, climate and requirments must be considered. Two schools, in regard to pruning, have sprung up, each advocating a system diametrically opposed to the other, and each backing its opinions with plausible arguments—the one favouring high pruning, the other low ; one heavy pruning, the other

light. It is argued in favour of the high cut tree that it is much easier to cultivate the orchard when a horse can be driven under the limbs, than when it is necessary to work under them with a hoe, as when they are trained low. The advocates of high pruning, in answer to the objections that high pruned trees in hot climates are liable to sun-burn, state that they may be planted closer together and thus afford shade for each other. In favour of low pruning it is urged that the limbs bending beneath their weight of fruit will find support on the ground, that the trunks are protected from the sun, and that the fruit is easier to gather.

### Yield.

The prune is a prolific bearer, and can be relied upon for annual crops. Unlike many fruits, it does not take an occasional season's rest but will yield its average returns every season. If properly cultivated some fruit may be gathered the third year, and the fourth year will yield a fairly profitable crop; the fifth year will give from 50 to 60 lbs. to the tree, which the sixth year should double. From this time on the tree can be considered as in full bearing, and will give from 150 to 300 lbs. of green fruit annually. The average yield for Santa Clara county is about 300 lbs. per tree. In some instances 600 to 800 lbs. to the tree are reported, and one six-year old tree in Visalia is credited with 1,102 lbs. of green fruit in one season.

### Picking and Curing.

The prune is picked from the tree when fully ripe, which is indicated when it passes from light reddish to purple, and by the withering condition of the fruit. It is very important that the fruit be thoroughly ripe, or else when dried it will be devoid of that rich flavour so essential in a marketable fruit. In most sections the prune upon ripening has a tendency to drop to the ground, which fruit is gathered and processed with the rest of the crop. The picking of the fruit, simple as the process appears, is one of the most particular things in prune cultivation Many of the leading growers go over their orchards eight or ten times, gathering the ripest fruit each time. People are kept continually at work in the season gathering the ripe fruit. Starting at one end of the orchard they will work it over, and by the time they have got through the part first gathered is ready for the second picking, and this is repeated until the entire crop is harvested. The object is to get the fruit in its prime condition—rich, full, meaty, and thoroughly ripe. If it dries on the tree a little and begins to shrivel it is none the worse. The fruit is usually allowed to drop on the ground, from whence it is gathered, and no greater assistance is given it in falling than the gentlest tap on the trumk of the tree; a severe shaking even is not allowed. At the last picking the fruit that remains on the tree is gathered with that which has fallen. By this method the fruit is assured of positive ripeness, is solid, and is charged with saccharine matter so desirable in the cured article. The prune will generally drop from the tree when fully ripe, and will not rot even if left on the ground under the trees for several days. As the fruit shows indications of ripening the ground under the trees is generally cleared of all rubbish and worthless fruit, so that when the mature fruit does fall it can be gathered by itself, free from rubbish Sometimes a sheet is placed upon the ground under the tree, and the ripe fruit is shaken into it, after which the sheet is picked up by the corner, and the fruit turned into boxes and loaded on a waggon, to be taken to the drying ground.

### Grading and Curing.

Prunes are generally graded before drying, and various home-made contrivances are employed. Some use inclined planes of adjustable slats, the grader being thus available for other fruit than prunes; the large fruit rolls along into receptacles at the bottom, while the small fruit falls through into other receptacles. Other grading devices are made with wire screens, or riddles of different sizes of mesh. Some of them work on the principle of a fanning mill—three or four riddles placed one above the other, each with a slight incline, and a spout on the side, where each grade drops into a box. Some have a long riddle, say 12 feet long, with three different sizes of wire screen on it. This riddle is hung upon four ropes, with an incline; the prunes are thrown in at the higher end, and by shaking it they roll down and fall through the holes into boxes underneath. The first piece of screen should be small, to let only stems and dirt through, and no prunes. This long, hanging screen is also used to grade prunes after drying.

The object to be attained by grading before drying is equality in drying. The smaller fruit dries more rapidly than the larger, and by grading it into two or three sizes, as it comes from the tree, greater uniformity in evaporation is secured, and a more even quality of finished fruit is the result. The grader also removes all twigs, leaves, or other foreign substances which may have become mixed with the fruit in picking.

The next process to which the fruit is subjected is known as dipping. This is one of the most important processes in the whole preparation of the prune for market, and much of the success of the pack will depend upon the person having it in charge. The ripeness of the fruit, the toughness of the skin, and other peculiarities of the fruit have to be considered in the preparation of the lye into which it is dipped, so that no certain rule can be laid down. The object to be attained is to remove the bloom, which fills up the pores, and at the same time crack the skin of the fruit so that evaporation may take place more rapidly. In its natural state the skin of the prune is almost impervious, and unless dipped the fruit would consume weeks if not months in drying. The usual strength of the dip is about 1 lb. of concentrated lye to each 10 gallons of water. The proper strength, however, must be left to the judgment of the operator, and the lye must be sufficiently strong to crack the skin of the prune. The lye must be kept boiling hot during the operation, and not allowed to cool by the immersion of the fruit. The length of time required for immersion also varies according to the toughness of the skin, the soil upon which the fruit is grown, and the age of the orchard, fruit from old orchards and heavy land being tougher than that from young orchards and freer soils. The average time required is about 30 seconds, but the fruit must be withdrawn as soon as the skin shows minute cracks on its surface. If left too long the sugar will ooze through the cracks in drying, rendering the fruit sticky and disagreeable to handle, and causing it to lose much of its best qualities; if it is removed too soon it will not dry well. After their removal from the lye bath, the scalded prunes are next plunged into clean, fresh water, which rinses off all the lye that may have adhered to them in the first operation. This water must be changed frequently to prevent its becoming too heavily impregnated with lye. For dipping the fruit is put into wire baskets, or galvanised pails with perforated sides and bottoms. In the Buxton orchard, at Campbell, in Santa Clara county, a very ingenious device is used, which does the work automatically. The prunes are taken direct from the orchard,

and unloaded into a bin. Elevators raise them to the grader, which removes all twigs, leaves, and rubbish, and assorts the fruit into two sizes. These two sizes each fall into an endless apron, provided with carrying slats, and are carried through the lye baths, which are kept at a boiling pitch by steam pipes, a separate bath being provided for each sized fruit. The apron continues from the lye bath into the rinsing bath, which is kept fresh by a continuous stream of pure water which flows through it, and from the rinsing bath the fruit is delivered to the trays.

Drying is done wholly by the sun. A number of experiments with driers have been made, but the machines were found wholly inadequate to handle the crops, and sunshine was found so much superior that they have fallen into almost complete disuse, and are now used to so limited an extent as to require no consideration in connexion with the prune industry. After the fruit comes from its second, or fresh-water bath, it is spread evenly on trays of a convenient size, usually about two by three feet, made of thin timber and easy to handle, and these trays are placed on the drying ground, a space which has been carefully selected with a view to its full exposure to the sun. The drying season extends from the middle of August until the beginning of November. The length of time required for the complete desiccation of the fruit depends upon the weather, its heat, and the humidity of the atmosphere.

In hot, dry conditions, the fruit requires a shorter exposure than where it is cool and moist. The drying period will vary under these circumstances from a week to a month, and the time at which to remove the fruit from the drying grounds must be left to the judgment of the operator. It should, however, be sufficiently well dried to warrant its keeping under all conditions, but not so dry as to rattle. When sufficiently dried the fruit is taken to the processing house, where it is put into bins to "sweat." This operation requires from two to three weeks, during which period the fruit must be carefully shovelled over several times and thoroughly intermixed. At the end of the sweating season it assumes a black, glossy appearance, and resumes somewhat of its original plumpness.

## Finishing.

The next process is that of "finishing." This comprises a second bath, to which the now dried fruit is subjected. This bath is simply boiling water, to which is added such ingredients as the judgment or the whim of the individual grower may fancy will improve the appearance or quality of his fruit. The objects to be obtained in the second dipping are to destroy whatever insect germs may have become attached in drying, and to soften the skin. The fruit should be left in the bath until partially cooked and these ends are accomplished. Some growers add sufficient salt to the dip to make it a fairly strong brine, and this has the advantage of increasing the heat of the water several degrees beyond that to which fresh water can be heated, and making its effect surer. Others add a small quantity of glycerine, glucose, fruit juices, and some few logwood or indigo. This is done for the purpose of improving the appearance of the fruit and adding to its gloss and colour. Many of the most experienced packers decry the addition of any of the last-named articles, claiming that they are ineffective, and do not add either to the quality or appearance of the fruit. In about three hours the fruit will be sufficiently dry for packing.

Before passing the finishing process the fruit is once more run through the grader and assorted into standard sizes for the market.

There are usually six sizes: first, those ranging from 40 to 50 to the pound; second, 50 to 60 to the pound; third, 60 to 70 to the pound; fourth, 70 to 80 to the pound; fifth, 80 to 90 to the pound; and sixth, all below 90.

### Packing.

The final operation in the handling of the prune is packing, and here again great judgment is required in putting up a thoroughly good article, that will present an attractive appearance and force its way on the market. Great care must be exercised that no fruit be packed until all surplus moisture between the fruit has entirely disappeared, for if packed while damp the fruit will mould in the packages; at the same time all fruit that is overdried must be thrown out. The skilful packer can tell by the sense of touch just what fruit is fit for packing, and that which is not, as he runs his fingers over the piles before him. Much of the fruit is packed in boxes of 10 lbs., 25 lbs., and 50 lbs. each, but of late there is a growing demand for fruit in sacks, and large quantities are now shipped to the Eastern States in 100 lb. sacks, where it is either boxed by the eastern dealer or sold direct from the sacks to the consumer.

The prune crop of 1889 was variously estimated at from 15,000,000 lbs. to 18,000,000 lbs., and it was sold at fair prices, ranging from 5 c. to 9 c. ($2\frac{1}{2}d.$ to $4\frac{1}{2}d.$) per lb., the average in the market being 2 c. (1*d.*) higher than the imported. The crop of 1890 was expected to fall short, owing to excessive rain upon the bloom, and the excessive moisture in the soil, which caused much of the fruit to drop after having attained a fair size. At the end of the season it was apparent that the output was but very little, if at all, less than the preceding year. Prices for green fruit delivered at the driers' ranged from 21 dol. to 30 dol. (4*l.* 6*s.* 9*d.* to 6*l.* 4*s.*) per ton.

The following table gives the foreign import and California production for the six years from 1885 to 1891, inclusive:—

| Year. | Foreign Imports, by years, ending June 30th. | | California Production, by years, ending December 31st. | |
|---|---|---|---|---|
| | Quantity. | Value in currency. | Quantity. | Value in sterling. |
| | Pounds. | Dollars. | Pounds. | £ s. d. |
| 1885 - - | 57,631,820 | 2,147,505 | — | 443,699 7 4 |
| 1886 - - | 64,995,545 | 2,026,595 | 2,000,000 | 418,717 19 4 |
| 1887 - - | 92,032,625 | 2,999,648 | 1,825,000 | 619,761 19 6 |
| 1888 - - | 70,626,027 | 2,197,150 | 2,100,000 | 453,956 12 1 |
| 1889 - - | 46,154,825 | 1,423,304 | 15,200,000 | 294,071 1 5 |
| 1890 - - | 58,093,410 | 1,789,176 | 12,200,000 | 369,663 19 2 |
| 1891 - - | 34,281,322 | 2,054,486 | 27,000,000 | 424,480 11 5 |

The importation of prunes into the United States for the year 1890, to December 31st, was 61,905,782 lbs. valued at 2,819,420 dol. (582,524*l.* 15*s.* 8*d.*), an increase over the importation of 1889 of 18,188,429 lbs., and an increased value of 584,029 dol. (120,667*l.* 2*s.* 11*d.*) The product of the State of California for the same period is given for 1889 at 15,200,000 lbs., and 1890 at 12,200,000 lbs., or 28,517,353 lbs. less than were imported in 1890. It would appear that while the

United States imports form three to four times the quantity of prunes produced by California, there is still a large field for our domestic fruit, and that with our continually increasing population, the danger of over supply is still very remote, and prune growing in California may be relied upon as a profitable industry for years, if not for generations, yet to come.

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## CCLXXVII.—SUGAR-CANE BORERS IN THE WEST INDIES.

The *Kew Bulletin* for July and August last, pp. 153–178, contained an elaborate report by Mr. Blandford on the borers (more especially the "shot-borer" *Xyleborus perforans*) that infest sugar-canes in the West Indies. This account was illustrated by figures in different stages of the several insects known as sugar-cane borers. The subject appears still to occupy a good deal of attention, and the following letter received at Kew from St. Vincent shows that as regards the moth-borer (*Chilo* [Diatræa] *saccharalis*) steps are being taken to deal with it in a practical way by planters.* It may be well, however, to state that the circumstances vary a good deal in the several islands. The prevailing sugar-cane borer in St. Vincent and Grenada, for instance, may be entirely different from the prevailing borer in Barbados and Trinidad. This fact has not, so far, been so fully recognised as it deserves by those who have written on the subject, and hence a good deal of confusion has arisen amongst planters as to the best steps to be taken in their particular circumstances. For the purpose of assisting in the identification of the several borers the illustration already given in the *Kew Bulletin* will be of service. Where the moth-borer (*Chilo saccharalis*) and the weevil-borer (*Sphenophorus sacchari*) are prevalent it is probable that they attack healthy or sickly canes indiscriminately. The history of their occurrence now extending, in one case at least over a period of more than 60 years, appears to fully bear out this view. As regards the shot-borer (*Xyleborus perforans*) the evidence is by no means conclusive. This may attack canes already infected by either of the other two borers, or it may attack perfectly healthy canes. There is a third alternative which appears to find support amongst several who have investigated the circumstances on the spot, and that is that the shot borer follows the attack of a fungus permeating the tissues of the canes, and rendering them an easy prey to the borer. The occurrence and habit of this fungus appear to require very careful and systematic observation. The specimens of canes infested by fungus forwarded to Kew from time to time by Mr. J. H. Hart have been carefully examined but the results so far obtained are by no means conclusive in favour of adopting the fungus theory as sufficient to account for the widespread injury to sugar canes that have been reported from Trinidad and elsewhere. Many are inclined to believe that the vitality of the present races of sugar cane cultivated in the West Indies has been so reduced that they fall an easy prey to any disease. The circumstances and vicissitudes of season as regards rainfall and temperature are probably more powerful factors than is usually supposed in determining the health and vigour of the canes.

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* The moth-borer is indifferently referred to as *Chilo saccharalis* or *Diatræa saccharalis*. The former name is adopted in this article.

The following further correspondence respecting borers in sugar canes at St. Vincent and Barbados has been addressed to Kew :—

Mr. J. G. Coull to Royal Gardens, Kew.

Dear Sir, St. Vincent, 7th September 1892.

In the August number of the *Kew Bulletin* I notice an exceedingly good article on the cane borer in the West Indies, by Mr. W. F. H. Blandford.

The disputed point of whether the *Xyleborus perforans* kills the cane or follows the moth borer (*Chilo saccharalis*) will, I think, be nearly set at rest by the knowledge we have gained this season, and by the specimens of canes which I now send on by this mail for transmission to you for Mr. Blandford's information.

The canes sent have been killed by the moth borer, the marks of which do not appear on any part of the jointed cane; but on looking carefully they will be found at the very top of the cane, in the soft pith from which spring the leaves, the body being free from the moth borer holes, but it will be found to be full of those of the *Xyleborus perforans* at the joints, and in the inside of the cane they will also be found, sometimes in great numbers, the cane having the sickening smell of decomposition. These canes were cut out of a piece of *standovers*, that is, canes that should have been cut in June or July, but on account of the rain have been left until next month. In this piece, I suppose, 10 per cent. of the canes are dead, but the remaining ones are free from disease, and show no signs of either the moth borer or the *Xyleborus perforans*.

I therefore think that the opinion of Mr. G. W. Smith of Grenada, and also that of Mr. Herbert H. Smith, is correct, that the cane is attacked by the moth borer, and when the health of the cane has been injured and acidity sets in, then the *Xyleborus perforans* takes possession. This has escaped attention before, because we have always looked for the marks on the jointed part of the cane; but this season has revealed to us that the place which is mostly attacked is the top of the cane, and in most instances the centre leaf is destroyed before it issues out, the cane dies, and is then taken possession of by the *Xyleborus perforans*. In canes on the leeward side of the island the cane is not so hard, and the moth borer enters the joints, but prefers the top even then, sometimes coming out after entering, and going up higher to the soft pith.

I have now no hesitation in saying that attacks by the moth are at periods of between 50 to 60 days, and that the proper time to destroy them is when they attack the young sprouts in May, June, and July, when *all plants* showing signs of disease should be cut out; again careful inspection in August and September, and again in November and December; this, with the burning off of the cane pieces which are affected after cutting, will, I feel sure, *if carefully carried out*, soon rid us of this insect pest. The first can be done with but little injury to the next crop, but *if not done* until later, there is every probability that the number of diseased canes will be largely increased at each period of 50 to 60 days afterwards.

Hoping that the specimens now sent may be of use in elucidating some of the habits of these borers,

I am, &c.

The Director, (Signed) James G. Coull.

Royal Gardens, Kew.

## REPORT on SPECIMENS of SUGAR CANE attacked by BORERS, from St. Vincent, by Mr. W. F. H. BLANDFORD, F.E.S., F.Z.S.

I HAVE examined the series of sugar canes forwarded to the Royal Gardens, Kew, by Mr. James Coull of St. Vincent, West Indies, to illustrate the points mentioned in his accompanying letter.

They are the apical portions of 11 canes cut at distances from the summit varying from 3 ft. 4 ins. to 5 ft. They show the following points:—

1. All have been attacked by both the large and small borers.

2. The large borers include both the moth borer (*Chilo saccharalis*) and the weevil borer (*Sphenophorus sacchari*, or an allied species). Of the latter a grub and of the former empty pupal skins and one small caterpillar were found, which latter was accidentally lost before it could be carefully examined.

3. The burrows of the weevil, when old, are not readily distinguishable from those of the *Chilo*, but when fresh are packed with a mass of woody fibre different from the more granular excrement contained in the moth tunnels. It is desirable to distinguish when possible the work of these two insects; when grubs are present this will be easy if it is remembered that the weevil grub is legless, whereas the caterpillar has 16 legs.

4. The burrows of the larger borers are all towards the summit of the cane, as described by Mr. Coull. The lowest holes visible on the outside vary from an inch to 39 inches below the tip, with an average of nine inches. They may extend inside the cane for three or more inches below the lowest external hole.

5. The canes are as a rule healthy looking, except for the last 12 inches or so, which contain the tunnels of the larger borers, and are shrivelled and often much decayed. The shrivelling usually corresponds to the length of the burrows inside the cane, and is a fair guide to their extent; it appears to me to have taken place during the life of the cane, and together with the withering of the tops to form a ready means of recognising borer-injury to the summits of standing canes.

6. When allowance has been made for the fact that the caterpillars often leave the cane to re-enter it at another point (which is not likely to be the case with the weevil grubs), seven canes at least show evidence of two or more separate attacks of the larger borers, and in two cases both weevil and *Chilo* burrows occur in the same cane. If the canes are only rarely attacked at the tips, these cases of double injury would be remarkable.

7. However far the burrows extend down the canes, which depends chiefly on the number of separate attacks, the terminal joints are invariably destroyed. The apical crown of leaves is only twice present, and in each case is pierced by borer holes; the tips are eaten completely off, and were only held in place by the surrounding leaves.

8. The injury to the extreme tips appears to be always caused by the moth-borer.

9. The holes of the small shot-borers (*Xyleborus perforans*) are commonest in the lower part of the stem and become fewer upwards, ceasing in one or two cases in the middle of the portion sent. They recommence in the neighbourhood of the large burrows, and are there always present, but if the top of the cane is very rotten only a few are to be found. A favourite point of attack is the first or second node just below the large burrows.

10. Most of the larger borer holes are old and untenanted, whereas the *Xyleborus* burrows are recent and contain living insects in all stages. As exit holes are only present in one or two canes, the *Xylebori* cannot have inhabited them long, and must have followed the large borers in point of time. In fact, some of their attacks have been begun since the canes were cut and packed.

11. Abrasions on the cortex of the cane, which may result from the nibbling of a caterpillar, or from injury received in trashing, lead in almost every case to entrance holes of the *Xylebori*, showing that these are ready to avail themselves of any assistance in the work of tunnelling the canes.

12. I have counted the entrance holes of the *Xylebori* on eight canes; out of 98 which occur singly, or at most two to a node, 52, or more than half, are in the bud or just at its base. If they are all reckoned the average is less, for out of 12 holes in a node, only two or three will be made in the eye. The *Xylebori* have obviously a preference for boring into this weak point, and in these particular canes do not appear to attack the aerial root-points.

13. The box, made of soft and rather new deal, in which the canes were packed, was attacked by the *Xylebori*.

Mr. Coull is right in his account of the injury done to the tips, and it is most important that this shall be taken into account in any investigations. I cannot find that special attention has been called to it before, but Mr. H. H. Smith has observed that the eggs of the *Chilo* are laid on the young cane leaves which will be near the summit in older plants, and it remains to be seen whether this attack on the extreme tip of the cane is general or whether it only takes place on the old canes (*standovers*) from which these specimens have been cut. As they were selected to show this point I have no means of telling except from Mr. Coull's statements whether it is common. The period of 50–60 days which he gives as that between the successive broods of the moth borer agrees with the statements of other writers, but some give it as 5–6 weeks. As it is founded, like the rest of his statements, on careful observation, it is no doubt accurate. He has not observed the distinction between the *Chilo* and *Sphenophorus* attacks, nor recorded the life-period of the latter. As the caterpillars of the *Chilo* hibernate in the canes his account shows that these infested tops, unless carefully destroyed, may be dangerous centres of infection.

(Signed) W. F. H. Blandford.

## Royal Gardens, Kew, to Colonial Office.

Sir, Royal Gardens, Kew, 10th October 1892.

In continuation of my letter of the 8th August on the subject of borers in sugar cane in the West Indies, I am desired by Mr. Thiselton-Dyer to forward a copy of a letter received from Mr, James G. Coull, of St. Vincent, through Messrs. Porter, Goodwin, & Co.

2. This letter was accompanied by specimens of sugar canes attacked by borers, and both the letter and specimens were referred to Mr. W. F. H. Blandford, F.E.S., F.Z.S., to whom Kew is indebted for much valuable research in regard to borers in sugar cane in the West India Islands.

3. Mr. Blandford has furnished a detailed report on the canes (a copy is enclosed herewith) and he supports in the main the results

obtained by Mr. Coull. It is evident that in St. Vincent, at least, there is a practical effort being now made by the planters to deal with the borers in their cane fields. Mr. Thiselton-Dyer is of opinion that a copy of this correspondence may be usefully communicated to the Governments of Barbados, the Windward Islands, and Trinidad, for the information of those locally interested in the sugar industry.

I have, &c.
(Signed) D. Morris.

Edward Wingfield, Esq., C.B.,
Colonial Office, S.W.

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### Captain N. Forte to Royal Gardens, Kew.

7, The Paragon, Clifton, Bristol,
September 29th, 1892.

Sir,

I shall be much obliged if you would let me have a copy of the *Kew Bulletin* that was issued a few months back containing an account of the *Chilo saccharalis*. I have just arrived from Barbados where I have sugar estates which are suffering to some extent from this pest.

Since April last the managers on my estates have been cutting out regularly all the canes that are attacked by this moth, but this process cannot any longer be continued as the canes are now nine months old, and too thick for the labourers to search.

I understand that this moth is always present in the island, but it is only during the past two years it has caused any damage. Heavy and continuous rains that have prevailed since May have not done any injury to this moth, which is just as active now as it was prior to the rains setting in.

I understand that 70 years ago this moth did a good deal of injury in Barbados. I have this from an eye-witness. Unfortunately a great many planters in Barbados take no notice of this moth, and allow it to commit its depredations.

I am, &c.
(Signed) N. Forte.

D. Morris, Esq.

### Captain N. Forte to Royal Gardens, Kew.

7, The Paragon, Clifton, Bristol,
October 6th, 1892.

Dear Sir,

I thank you very much for your letter of the 30th September and the *Kew Bulletin* for July-August, which I have carefully studied, and compared with the observations I made during the past seven months spent in Barbados.

My own opinion is that the borer pest is caused by—

1. Drought.
2. Over-cultivation and the extensive use of artificial manures.
3. The degeneracy of the sugar-cane plants.

As it is only possible to deal with the second and third evils, I propose to reduce the cultivation of the cane and obtain a new breed of plants.

I have also planted on the borders of the fields on one of my estates the Pigeon Pea, which is supposed to attract the Ichneumon Fly which is stated, *by a very old planter*, to be parasitic on the *Chilo saccharalis*.

I am, &c.
(Signed) N. Forte.

D. Morris, Esq.

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## CCLXXVIII.—SISAL HEMP INDUSTRY IN YUCATAN.

A general review of the Sisal Hemp industry in various parts of the world was given in the *Kew Bulletin* for February last. Those specially interested in the subject cannot do better than obtain a copy of that number. A later account of the fibre industry in the Bahamas was communicated to Kew by his Excellency Sir Ambrose Shea, K.C.M.G., and published in the *Kew Bulletin* for May and June last, pp. 141–143. What seems to have been required to supplement and complete these accounts was some precise and detailed information respecting the various machines in use in Yucatan for extracting the fibre. It was felt that the success of the whole industry depended in a great measure upon this one point.

At the request of Sir Ambrose Shea, Captain E. Jerome Stuart, the Resident Justice of Long Island, was deputed to proceed to Yucatan with instructions to study the whole subject of fibre cultivation and production in that country and draw a comparison between the circumstances of Yucatan and Bahamas as regards soil, climate, and the general healthiness of the plants. Captain Jerome Stuart gave particular attention to the character of the machinery used for extracting the fibre, and he gives the results obtained from each machine. This part of his report will be read with interest. There are apparently no insuperable difficulties met with in Yucatan in extracting the fibre from Agave leaves. The total exports of fibre from Yucatan are of the annual value of more than a million and a half sterling, and if, as is shown by Captain Jerome Stuart, this large and valuable industry is capable of being continuously carried on by means of machines in regular use there should be no difficulty in selecting one or more of these machines for use elsewhere. The only advantage possessed by Yucatan is apparently that of cheap labour. The rate of pay of the Indians on fibre estates is much below that of negroes in the West Indian islands; but if the higher value of the Bahamas fibre is maintained, Yucatan would appear to possess no advantages not shared by other countries.

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Report on the Fibre Industry of Yucatan addressed to Sir Ambrose Shea, K.C.M.G., Governor of the Bahamas, by Captain E. Jerome Stuart.

In accordance with instructions received from your Excellency on the 15th ultimo, I sailed on that date for Yucatan, for the purpose of comparing the soil of the Bahamas and its adaptability to the fibre industry, with the soil of that State: to find out the different species of Agaves planted, and their liability to disease: the character of the machinery used for extracting the Henequen fibre and the cultivation and general management of the crops.

When in the State I visited 28 Henequen estates, and after careful inquiry I have the honour to submit the following report:—

### The Soil of Yucatan compared with that of the Bahamas.

The soil in the "fibre producing district" of Yucatan is gravelly and stony, and varies in colour, being black, brown, and red. There are large tracts of land in the district, similar to that on most of our islands,

and known as "mixed land." The soil has an average depth of 8 inches, and is underlaid by soft limestone rock, similar to that of our "Pine Barren" lands.

The largest fibre fields in the State are to be found on this shallow stony soil; and the yield of fibre is greater than on the deeper soil 30 miles further inland.

I could not, when looking at the fibre fields of Yucatan, doubt for a moment that the fibre fields of this colony are equally good; and if the growth of plants is any guarantee of the virtue contained in the soil in which they grow, I do not hesitate in saying that the soil of the Bahamas is equally as good as the soil of Yucatan.

Any one who will look over the grounds of Fort Charlotte will see the soil, trees, and weeds of the fibre fields of Yucatan, with this difference, that the soil there is more stony.

## The Different Sorts of Agaves.

There are several species of Agaves to be found in Yucatan, but as two only are of chief commercial value, I confine my report to those two.

*The Henequen.*—The kind of fibre plant growing in Yucatan, and known as the Sacqui or Henequen is a different and distinct Agave from that of the Bahama hemp.

The plant is hardy, and has, when cultivated, an average life of 18 years; and propagates itself by sending out "suckers" from its roots.

The Henequen (*Agave rigida* var. *elongata*) requires from five to eight years growth to produce a marketable length (3 feet) of fibre. The leaf from which the fibre is extracted has a thorn at the point, and spines on its edges, and averages 3¼ feet in length.

The fibre of the plant is white, but being inferior to that of the Bahama Hemp is rated in the market at from 6*l.* to 8*l.* per ton lower.*

*The Bahama Hemp.*—The Bahama Hemp (*Agave rigida* var. *sisalana*) differs from the Henequen inasmuch as the leaves are without spines on their edges; and the fibre is superior in texture. The plant matures from two to three years earlier than the Henequen, and has an average life of 12 years. Like the Henequen it propagates itself from suckers, but is also capable of producing over 2,000 plants from the pole that grows from the centre of the plant.

The Bahama Hemp is found both in Yucatan, where it is known as the Yaxqui, and in Cuba, but it is not largely cultivated, as it requires a more congenial climate than these countries afford. In this colony the plant luxuriates, the length of leaf being 4½ feet to 5 feet, weighing 1½ to 2 lbs. In Yucatan a leaf of the Yaxqui from a plant of the same age would measure 3¼ feet, and weigh 11 ounces only.

## The Plant's Tenacity of Life.

The Henequen and Bahama Hemp are the hardest of all the Agaves. Their power to withstand drought is almost incredible. I have known plants of the Bahama Hemp to lie on the ground for three months, exposed to the rays of the sun, and when planted to grow with the greatest vigour.

It has never been known for these plants to be troubled with any organic disease. No fungus or insect can apparently damage or affect

* At present date, 20th June, rated at 6*l.* lower.

them; and, in 1883, when the locust devastated the State of Yucatan, the cattle and birds died of starvation, and men were on the eve of despair, the only green living plants to be seen were the different species of Agaves, and they are now looked upon as the salvation of the State.

Although not apparently subjected to disease, and capable of resisting a drought of 11 months in 12, the plant is not altogether free from the effects of sudden changes of heat and cold, and is liable to be damaged by floods of rain immediately after a long drought, if accompanied by a *sudden fall of temperature.* This happened in Yucatan in 1888, when, after a severe drought, the rains came on suddenly, with hail and a heavy wind from the north-west, with a fall of temperature from 89 deg. to 57 deg., and within one night about 90 per cent. of the plants were damaged or blasted on the ends of the leaves, about an average of three leaves to the plant being affected, causing a loss of 3 per cent. to 5 per cent. of leaf. A similar change after a protracted drought happened in this colony in March last, when a few of our farms were affected; but after cutting off the ends of the injured leaves there was nothing more seen of the trouble, and the plants remained healthy and strong. I am told that this frequently happens in Florida, as the atmosphere is more changeable than in the Bahamas; but as this colony is protected by the Gulf stream, there is no probability of its happening here with frequency, and in Yucatan it has happened once only in 30 years. The blast is caused by a sudden atmospheric change over which we have and can have no control, and may happen at any time; but the loss of leaf, 3 per cent. to 4 per cent., even 5 per cent., would be so slight that it may be looked upon with unconcern.

I walked through hundreds of acres of the Henequen, but beyond noticing that a leaf here and there had a few inches dried on its end, similar to what is seen in this colony and Cuba, the plants were perfectly healthy and free from disease.

## Kind of Machinery used.

There are several kinds of machinery used for extracting the fibre on the different estates.

Those cleaning less than 75,000 leaves per day use the large common wheels, Raspador and Barraclough; and those cleaning from 80,000 to 120,000 per day use the larger and more complicated machines, the Prieto, Villamore, Weicher, Death and Ellwood, &c.

The planters, if using one of the large machines, keep several of the Raspadors in reserve for use in case of accidents; for should the large machine break down or get out of order, leaving 70,000 or 80,000 leaves on hand, and there be no means of cleaning them, it would involve a loss of over 4,000 lbs. of fibre.

*Cleaning Machines.*—The *Raspador* is a 54-inch "wheel," said to be invented and manufactured in Mexico. It requires a two-horse power engine to run it at a steady rate of 200 revolutions per minute, at which speed the best results are obtained. Capacity 500 lbs. dry fibre per day of 10 hours; requires the services of two men.

The *Barraclough*, constructed by T. Barraclough & Co., Manchester, England, is similar to the Raspador, but of superior make. Capacity 500 to 600 lbs. dry fibre daily.

The *Prieto* machine is manufactured by Ping and Negre, Barcelona, Spain; requires a 16-horse power engine and the services of two men and a boy. Capacity 7,000 lbs. dry fibre per day of 10 hours. Cost 4,500 dollars.

The *Villamore* machine, made by Krajewski and Pesant, 35, Broadway, New York; requires a 15-horse power engine and the services of two men and a boy. Capacity 6,000 lbs. fibre per day of 10 hours. Frame made of wood. Cost 500 dollars.

The *Weicher* machine, constructed by J. J. Weicher, 108, Liberty Street, New York, is fitted with a service pipe for throwing a stream of water on the fibre as it is being cleaned, and is claimed by the inventor to lose but 1½ per cent. only, as the leaves are fed into the machine endwise. Requires 12-horse power engine and services of three men. Capacity 2,500 lbs. dry fibre per day of 10 hours.

The *Death and Ellwood* machine, constructed by W. E. Death, of Brixton, England, requires a 3-horse power engine to drive it at a velocity of 400 revolutions per minute, and washes the fibre when cleaning. Like the "Weicher," the leaves are fed into the machine endwise. Capacity 250 lbs. [?] of dry fibre per day of 10 hours.

With the exception of the Raspador and Barraclough all the other machines are automatic; they rasp the pulp from the fibre on the same principle as the Raspador. Their wheels being smaller, require a velocity of 500 revolutions to the minute to give good results. Beyond cleaning a greater number of leaves they do not appear to do better work, as the per-centage of loss is as great in the one as the other, and the fibre is equally as clean.

*Engines and Boilers.*—The engines used were from 6 to 80 horse power, manufactured by Marshal and Son, London; Appleby Bros., London; Fawcett and Preston, Liverpool; Watts, Campbell & Co., Newark, N.J.; H. M. Sciple, Corner 3rd and Arch Street, Philadelphia.

The estates running 60 to 80 horse power engines have two boilers, using them alternately every 15 days.

*Press.*—Most of the small estates use small screw presses, baling from 3 to 8 bales daily. The large estates, baling 16 to 30 bales daily, use hydraulic presses, constructed by Appleby Bros., London, and Fawcett and Preston, Liverpool.

*Locomotive, Tramway Rails, &c.*—The locomotive cars are made of wood, 20 feet by 4 feet. The rails are of iron with gauge 3 feet, and sleepers of wood 2 feet apart.

Tramway trucks are of iron or wood; they are 12 feet by 3 feet. Rails and sleepers of iron with gauge 2 feet 4 inches, and sleepers 2 feet apart.

Locomotives and tram cars with rails are manufactured by Charles Wood, Trees Iron Works, Middlesbrough, England.

## Cultivation of the Agaves.

*The Estates.*—There are 200 Henequen estates in Yucatan, varying from 500 to 28,000 acres in extent, having a total number of 105,000 acres under cultivation, employing 12,000 Indian labourers.

The largest and best estates are on the rocky gravelly lands, and they are valued from 100,000 dollars to 500,000 dollars each. Each estate is managed by three principal men—the attorney, the manager, and assistant manager. The largest of them employ locomotives for hauling in the crop from the fields, others using tramway trucks or carts drawn by mules or oxen.

Estates with less than 800 acres under cultivation erect one Raspador for every 100 acres. Those of 1,000 acres use the large automatic machines.

*Preparing the Fields.*—The size of the cultivations on the estates range from 250 to 3,500 acres. They are laid out in fields or sections of 50 to 200 acres, and contain from 600 to 900 plants to the acre.

When preparing the fields the land is cut during the dry season, is then allowed to spring up, after which it is "sprig weeded," and burnt after the first fall of rain. The stumps are cut close to the ground, so as to be out of the way of the leaves of the plants, and to facilitate the running of the line for planting and getting the rows straight.

*Planting.*—The plants are "set out" on the different estates at various distances, being 6 ft. by 11 ft., 5 ft. by 11 ft., 4 ft. by 11 ft., 6 ft. by 10 ft., 5 ft. by 10 ft., 4 ft. by 10 ft., 6 ft. by 9 ft., 5 ft. by 9 ft., 4 ft. by 9 ft., 6 ft. by 8 ft.

The rows are kept perfectly straight, for if they be otherwise there would be the greatest difficulty in getting through the fields.

When planting, the labourers have a small line with the distances at which the plants are to be "set out" knotted on it. and a pole cut to the length that the rows are to be apart. A man and a boy are employed at each line. The boy drops the plants along the row at the distance marked on the line, and then removes the line to the next row, dropping the plants as before. The man does the planting, and is responsible for the rows being straight. When coming to a rock the planter does not turn aside, but goes on, and places the plant in the row a little beyond.

The row system facilitates weeding, admits a free current of air and sunlight, which is necessary to harden and give strength and texture to the fibre; allows the labourer to cut and bring out the leaf with despatch; and, what is of the greatest importance, gives room for replanting the field when the life of the old plants is about to terminate, which cannot be done if the plants are growiug over the field irregularly.

Plants of less than 15 inches are not planted.

## Management of the Crop.

*Cutting.*—In Yucatan the Henequen matures in five to eight years. In the Bahamas the Bahama hemp matures in three to five years.

To neglect cutting the leaves after the plant is matured retards its growth, which causes it to "pole," at the appearance of which the life of the plant is ended, and the planter, after reaping a few leaves only, must then plant his fields afresh. On the other hand, when the cutting is regularly attended to, the life of the plant is prolonged, the plant will produce a greater number of leaves, and fibre of a greater length and superior quality.

The plant is cut every three months, when seven to nine leaves are gathered. The leaf is taken from the plant with a "clean cut," making the cut down and inward at an angle of 45 deg.

*Cleaning.*—As soon as the leaves are cut they are taken to the machine for cleaning. The cleaning is so arranged that one-half of the leaves to be cleaned is taken from the cuttings of the day previous, and the other half from the cuttings of the same day, as in this manner the work can be commenced early in the morning, and steadily carried on without waiting for leaves to be brought in from the field. The leaves are not allowed to accumulate beyond half a day's cleaning, for if left to dry beyond the second day they become hard, and the fibre when extracted will be dark.

When the Raspador is used for extracting the fibre two operators are required; one stands to the left of the wheel and the other to the right. The operator on the left taking a leaf fastens the small end with a lever

to prevent the whole of it being drawn into the machine; the larger end is inserted and cleaned; the other operator then hauls out and reverses the leaf, putting in the uncleaned end, at the same time taking a turn with the cleaned end of the leaf around a brass cleat which is fitted to the machine for the purpose, and managing a brake that regulates the pressure required for cleaning the leaf, finally drawing out the clean fibre. In this manner 14 leaves per minute, or 8,400 leaves are cleaned for a day's work.

When cleaning with the Villamore, Prieto, or other automatic machines, all that is necessary is to lay the bundles of leaves on a platform fitted for the purpose, when an endless chain draws them into the machine, the mechanism of which is so arranged that one wheel cleans one-half of the leaf, the chain taking it along, where another wheel cleans the other half, and then throws out the clean fibre at the opposite end. Two men and a boy are employed at the machine, one man to see that the leaves enter the machine on their length, and that they do not ride one on the other; one to attend to and regulate the machine, and the boy to receive the fibre as it is brought out by the endless chain.

As soon as the fibre is extracted it is dried, for if allowed to remain without being exposed to the sun immediately after cleaning it becomes dark and spotted.

*Yield per Acre.*—The yield of fibre from an acre of Henequen is from 1,000 lbs. to 1,470 lbs. per annum. The number of plants usually set out in an acre is 650, giving an average of 33 leaves from each plant, and from 50 to 70 lbs. of clean fibre to the 1,000 leaves. Making an average calculation of 650 plants to the acre, 33 leaves from each plant, yielding 60 lbs. of fibre to the 1,000 leaves, the return would be as follows:—$33 \times 650 = 21{,}450$ leaves yielding $60 \times 21\frac{450}{1000} = 1{,}287$ lbs. clean fibre per annum. The planters never speak doubtfully of their returns, as experience shows them that their crops can be relied on with almost complete certainty.

*Cost of Working and Profits.*—The planter estimates his crop to cost for cultivating, cutting, cleaning, baling and marketing from 2½ cents. to 3 cents. per lb. At the present price of fibre 5 per cent. per lb. taking 3 cents. as the cost of production, an acre yielding 1,287 lbs. would give a net profit of 25 dollars.

After comparing the soil and plants of the Bahamas with that of Yucatan, I assure your Excellency that the one compares most favourably with the other; and that we have in this colony every requirement for the development of the enterprise, and I am most sanguine as to the ultimate result of the Bahama Hemp industry.

(Signed) E. JEROME STUART.

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## CCLXXIX.—LIBERIAN COFFEE IN THE MALAY NATIVE STATES.

Continued attention is being directed to the cultivation of Liberian coffee in different parts of the world. There are grounds for believing that the neglect into which it had fallen of late years is being gradually replaced by a greater interest in the capabilities of the plant, and in its undoubted value for cultivation at low elevations and in climates quite

unsuited to the ordinary Arabian coffee. From time to time articles have appeared in the *Kew Bulletin* on the subject,* while a general review of the progress of the industry is given in the number for November 1890, p. 245. The more important plantations yielding regular crops of Liberian coffee are established in Java and in the Straits Settlements. In the latter the yield of per acre in full bearing is given as ranging from $9\frac{1}{2}$ cwts. to $11\frac{1}{2}$ cwts. per acre. Placing the price of Liberian coffee as low as 90*s.* per cwt., this would show a gross return of from 42*l.* to 52*l.* per acre. This is a higher return than is obtained from almost any plantations of Arabian coffee. These figures, it should be remembered, are based on returns supplied to Kew by an experienced and competent planter, and the details are given below.

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## Liberian Coffee Crops from Estates in the Protected Native States of the Malay Peninsula.

Planters will be interested in the following statement of the produce of Liberian coffee estates in the native States.

| — | Produced. | Average per Acre for Years in Full Bearing. |
|---|---|---|
| **Linsum Estate, in Sungei Ujong—** | Piculs. Cwts. | |
| Weedy at times. | | |
| In 1884, 28 acres under 4 years old - - - | 84 or 99 | |
| „ 12 „ „ 3 „ - - - | | |
| In 1885, 28 „ over 4 „ - - - | 312 „ $307\frac{1}{2}$ | |
| „ 12 „ under 4 „ - - - | | |
| „ 25 „ „ 3 „ - - - | | |
| In 1886, 40 „ over 4 „ - - - | 311 „ 369 | |
| „ 25 „ under 4 „ - - - | | |
| In 1887, 65 acres of coffee in full bearing - - | 345 „ $409\frac{1}{2}$ | |
| „ 1888, 65 „ „ „ - - | 542 „ $643\frac{1}{2}$ | |
| „ 1889, 65 acres in full bearing - - - | 615 „ 732 | |
| „ 1890, 65 „ „ - - - | 583 „ 692 | |
| | 2,477 | |
| Average per acre for 4 years in full bearing - - | - - - | $9\frac{1}{2}$ cwts. |
| **S'lian Estate, in Sungei Ujong—** | | |
| Weedy at times. | | |
| In 1885, 8 acres under 4 years old - - - | 78 or 92 | |
| „ 28 „ „ 3 „ „ - - - | | |
| In 1886, 8 „ „ 5 „ „ - - - | 284 „ 336 | |
| „ 28 „ „ 4 „ „ - - - | | |
| „ 9 „ „ 3 „ „ - - - | | |
| In 1887, 36 „ „ 5 „ „ - - - | 208 „ 238 | |
| „ 9 „ „ 4 „ „ - - - | | |
| In 1888, 45 acres in full bearing - - - | 417 „ 495 | |
| „ 1889, 45 „ „ - - - | 396 „ 471 | |
| „ 1890, 45 „ „ - - - | 409 „ 481 | |
| | 1,447 | |
| Average per acre for 3 years in full bearing - - | - - - | $10\frac{7}{10}$ cwts. |

* *Kew Bulletin*, 1888, p. 261; 1890, pp. 107 and 245.

| — | Produced. | Average per Acre for Years in Full Bearing. |
|---|---|---|
| **Weld's Hill Estate, in Selangor—** | Piculs. Cwts. | |
| Clean. | | |
| In 1886, 19 acres under 4 years old - - - | 274 or 325 | |
| „ 36 „ over 4 „ „ - - - | | |
| In 1887, 55 acres of coffee in full bearing - - | 339 „ 402 | |
| „ 1888, 55 „ „ „ - - | 422 „ 501 | |
| „ 1889, 55 „ „ „ - - | 552 „ 657 | |
| „ 1890, 55 „ „ „ - - | 327 „ 376 | |
| | 1,936 | |
| Average per acre for 4 years in full bearing - - | - - - | $3\frac{8}{10}$ cwts. |
| **Batu Caves Estate, in Selangor—** | | |
| Weedy at times. | | |
| In 1888, $11\frac{1}{4}$ acres under 4 years old - - - | 66 or 78 | |
| „ 1889, $11\frac{1}{4}$ „ 5 „ - - - | 61 „ 72 | |
| „ 1890, $11\frac{1}{4}$ acres of coffee in full bearing - - | 111 „ 131 | |
| Average per acre for 1 year in full bearing - - | - - - | $11\frac{1}{2}$ cwts. |

### Remarks.

Crop was lost in 1884, 1885, 1886, and 1887, from want of labour.

The crop on Weld's Hill was thrown back by heavy pruning and unsuitable weather for ripening.

The crops for 1891 will not decrease these averages.

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## Mr. T. H. Hill to Royal Gardens, Kew.

Dear Sir, Sungei Ujong, May 19th, 1892.

* * * * *

I enclose you the returns of crop on my estates for 1891. You will see they are in a different form, as I now have the yield kept separately, field by field, to enable me to use my manure to the greatest advantage.

* * * * *

Yours, &c.
(Signed) T. H. Hill.

D. Morris, Esq.,
Royal Gardens, Kew.

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## Sungei Ujong.—Linsum Estate.

Crop from 1st January to 31st December 1891.

| Area in Acres. | No. of Field. | Date planted. | Age. | Boxes of Cherry. | Clean Coffee in Piculs.* | Yield per Acre in Piculs and Catties. | Remarks. |
|---|---|---|---|---|---|---|---|
| 15 | 1 | May to July 1881 - | 11 years - | 1,085¼ | 111 | 7·40 | |
| 25 | 2 | Early 1880 - | 11 years & 5 months. | 1,873 | 200 | 8· | Very wide planted. |
| 35 | 3 | December 1887, May 1888. | 4 years & over. | 197½ | 21½ | ·60 | Old cacao land planted. Many vacancies. |
| 22 | 4 & 5 | April to June 1882 | 10 years - | 1,760 | 188 | 8·50 | |
| 18 | 7 | October to November 1888. | 3 years & over. | 131 | 14¼ | ·70 | The out-turn is taken on the average whereas on young coffee 8 boxes make 1 picul. |

* A picul = 133⅓ pounds.

## Sungei Ujong.—S'lian Estate.

Crop from 1st January to 31st December 1891.

| Area in Acres. | No. of Field. | Date planted. | Age. | Boxes of Cherry. | Clean Coffee in Piculs. | Yield per Acre in Piculs and Catties. | Remarks. |
|---|---|---|---|---|---|---|---|
| 4 | 1 | In 1882 - - | 10 years - | 233 | 23 | 5·75 | |
| 9 | 2 | May 1882 - - | 10 „ - | 963 | 96 | 10·60 | |
| 23 | 3 | August 1882 - | 9 years & 8 months. | 1,376¼ | 138 | 6·00 | |
| 9 | 4 | September 1883 - | 8 years and 7 months. | 403½ | 40 | 4·40 | Close planted. |

## Selangor.—Weld's Hill Estate.

Crop from 1st January to 31st December 1891.

| Area in Acres. | No. of Field. | Date planted. | Age. | Boxes of Cherry. | Clean Coffee in Piculs. | Yield per Acre in Piculs and Catties. | Remarks. |
|---|---|---|---|---|---|---|---|
| 65 | — | August 1882 - | 9 years & 4 months. | 3,614 | 448·80 | 6·90 | Highly cultivated; *but* estate surrounded by open country. Chiefly grass. |
| 35 | — | October 1887 - | 4 years & 2 months. | 989 | 122·50 | 3·50 | |

## Selangor.—Batu Estate.

Crop from 1st January to 31st December 1891.

| Area in Acres. | No. of Field. | Date planted. | Age. | Boxes of Cherry. | Clean Coffee in Piculs. | Yield per Acre in Piculs and Catties. | Remarks. |
|---|---|---|---|---|---|---|---|
| 11¼ | — | May, June, 1884 - | 7 years - | 535 | 61·20 | 5·44 | Unmanured until 1891. |
| 3¼ | — | November 1887 - | 4 years, 1 month. | 151 | 17· - | 5·23 | |
| 17 | — | June 1888 - - | 3 years, 5 months. | 321 | 36·71 | 2·16 | |
| 15 | — | Nov. to Dec. 1888 | 2 years, 7 months. | 43 | 4·84 | ·21 | |
| 7 | — | October 1889 - | 2 years, 4 months. | | | | |

## Perak.—Kamming Estate.

Crop from 1st January to 31st December 1891.

| Area in Acres. | No. of Field. | Date planted. | Age. | Cherry Boxes. | Clean Coffee. | Yield per Acre. | Remarks. |
|---|---|---|---|---|---|---|---|
| 30 | 1 | October 1888 - | 3 years - | 735 | 71·20 | 51 catties | The full area of each field is given, but owing to failures of first planting, there were not more than 60 per cent. of the original trees, many of which had no crop. |
| 52 | | November 1888 - | 3 years, 1 month. | | | | |
| 56 | 2 | December 1888 - | 3 years - | | | | |

## Mr. T. H. Hill to Royal Gardens, Kew.

65, New Broad Street, E.C.,
August 4th, 1892.

My dear Mr. Morris,

Herewith the information that I promised you with regard to my estates on the Malay Peninsula, and also a few remarks that you can utilise if you find them suitable. I should like to sit down and write you a long article about Liberian coffee, and I will do so, but I am so pressed with work that I am unable at present to do more than I have. I will, if you desire it, try and send it you with my next year's crop returns. You see there is so much to be said, and it must be so carefully considered, if the Government get $2·40 per acre per annum from an acre in full bearing, surely they can afford to keep three acres of forest for each acre under coffee, which would still equal a quit-rent of 60 cents per acre on the whole area.

The labour question is another matter that ought to be carefully considered, but I suppose anything beyond a general reference to it would be out of place in the *Bulletin*.

Yours sincerely,
(Signed) T. H. Hill.

D. Morris, Esq., F.L.S.,
Assistant Director, Kew.

[Enclosure].

The returns from these Liberian coffee estates are interesting as showing that under favourable circumstances the yield is not showing any tendency to decrease. Linsum and S'Lian, in Sungei Ujong, estates are surrounded by forest, and the atmosphere there is generally laden with moisture (rainfall from 90″ to 120″) and rain falling on over 200 days in the year, with heavier and more continuous rains in October, November, and the early part of December. The older fields on these estates are manured yearly, and weeds are allowed to grow and have been for many years for a large portion of the year. At certain times the estates are, for periods varying from six weeks to three months, kept scrupulously clean. The cost of cultivation is from \$70 to \$90 per acre per annum. The soil is not particularly rich, but the climate, from the moisture, makes the estates very productive. The export duty of thirty (dollars) cents per picul produces to the Government an equivalent of a quit-rent of \$2·40 per acre, on the land in full bearing.

The younger fields on this estate are finer than the old coffee was at the same age, they all having been planted from selected seed from fine trees, thus getting a pedigree seed, some of the clearings being planted from the 4th generation of seed so selected, and the 5th generation of seed is now in the nursery.

Weld's Hill Estate is in Selangor, and owing to the growth of the town of Qualla Sumpor and its surroundings is in an open plain, so that although the rainfall is much the same, the evaporation is very much more rapid, and the yield of crop is not so large. This may partially be accounted for by the estate being more on the slopes of hills and therefore unsuitable for the growth of weeds. The boundaries of this estate are now being planted up with *Inga Saman*, *Albizzia moluccana*, and other quick-growing trees to alleviate this dry atmosphere as much as is possible. It suggests itself as a matter of grave consideration for the Governments as to how much the capital of these fertile countries is due to their humid climate produced by the large area of forest, and how much to the soil.

Batu Estate has not been manured until 1891, because the soil was so much superior to that of the other estates as to render it theoretically unnecessary to apply manure. In future the same system will be followed as on the other estates.

Kamming Estate.—The yield is very much decreased, owing to the large number of vacancies in the fields, the full areas of which are given, the supplies here are growing luxuriantly, and in a few years these fields will be regular, and from the appearances of the original planted trees, the climate and the soil, the yield should not be less than that on the older estates.

T. H. H.

# CCLXXX.—BOMBAY ALOE FIBRE.

(*Agave vivipara*, L.)

In the *Kew Bulletin*, 1890, p. 50, an account was given of a fibre known in commerce as Bombay Aloe Fibre prepared from *Agave vivipara*. It appears that there is a variegated form of this plant in India, and recently through the kindness of Mr. G. Marshall Woodrow, Lecturer on Botany at the College of Science, Poona, several living specimens were obtained for the Kew collections. In forwarding the specimens Mr. Woodrow supplied the following interesting information :—

Mr. G. Marshall Woodrow to Royal Gardens, Kew.

Dear Sir, College of Science, Poona, 19th May 1892.

In reply to your letter of the 23rd April, I have the pleasure of intimating despatch by parcel post of a box containing nine *Agave vivipara variegata* plants, with a mature leaf, and a branch with flowers of the typical plant of this variety.

There are two distinct forms of *Agave vivipara*, one has leaves attaining 4¼ feet in length by 2½ inches in breadth at the broadest part, which is near the centre; the other attains 2¼ feet in length, but is generally much shorter, it is of the same breadth as the other variety but somewhat thicker. The flowers are the same in both. The Marathee name is *Guial*.

The plant you refer to as having been received from the Bombay Government in 1890 is of the long-leaved variety; the one I send now is a variegated form of the short-leaved variety, it is a very ornamental plant.

I will be glad to send you a large number if you can make use of them, and can give a small plant of the Sisal Hemp in exchange; such plants thrive in this climate. I have lately received two very small offsets of a plant said to be Sisal Hemp, but I am doubtful of their identification.

The two varieties of *Agave vivipara* are grown as fences occasionally throughout South India, but are not found in forest lands or grown as field crops. I made experiments in growing the long-leaved variety as a field crop some years ago, but found that at the then price of the fibre it would be very unprofitable to grow this crop where Sunn (*Crotalaria juncea*) or Ambadee (*Hibiscus cannabinus*) would thrive.

I am much interested in your statement that *Agave vivipara* is the the Bombay Hemp. That name is not known here, I presume it is the London market name. I had not learned it, as the *Kew Bulletin* does not reach me, except the part that gives the list of seeds available for distribution.

Yours, &c.

The Director, (Signed) G. Marshall Woodrow.
Royal Gardens, Kew.

# CCLXXXI.—MISCELLANEOUS NOTES.

Mr. William Nicholls Winn, lately the label writer in the Royal Gardens, has been appointed, on the result of a competitive examination before the Civil Service Commissioners, an Assistant in the Royal Gardens from the 1st October last.

An account of an oil, known as Oil of Ben, obtained from *Moringa pterygosperma*, the common horse-radish tree of the tropics, was given in the *Kew Bulletin* for January 1887. Oil of Ben was also supposed to be yielded by *Moringa aptera*, a native of Upper Egypt and Arabia. The latter species was not known in cultivation, and its introduction as a possible source of a valuable oil, was regarded as a matter of some interest. Seeds were obtained by Kew in 1885, and distributed for experimental purposes to Jamaica, Dominica, Calcutta, and Ceylon. A further supply of seed was obtained in 1886 from Mr. E. A. Floyer, Inspector-General of Egyptian Telegraphs. The plants raised from these have now been increased by the addition of two plants presented to Kew by Mrs. Harris, of Steventon Manor, Hants. The young seedlings of *Moringa aptera* form a tuberous root which is eaten by the Bedouins. It is said to be similar in taste to the common radish. The plant has a singular broom-like habit and the very small entire leaves are caducous.

Stapelia Gigantea.—This, the largest flowered of all known stapelias, is now represented at Kew by a specimen bearing six flowers and buds. It is a native of Zululand, where it was discovered by Mr. Plant 30 years ago and sent to Natal, from whence it was sent to England by Mr. Cooper, at that time collector for the late Mr. Wilson Saunders. Although in cultivation so long there is no record of the plant flowering until October 1888, when a specimen in the rich collection formed by the late Sir George Macleay at Pendell Court flowered and was figured in the *Botanical Magazine*, t. 7,068. The flowers vary in size from 8 inches in diameter to 14 inches in diameter; they are coloured pale yellow mottled with red brown, and are covered with fine whitish hairs.

Dischidia Rafflesiana.—After many unsuccessful attempts to introduce living examples of this interesting plant Kew has at last succeeded, thanks mainly to the generosity of Dr. Treub, the distinguished Director of the Botanic Gardens, Java, who sent a plant of it in a Wardian case two years ago. This plant is now established and growing freely, producing numerous large pitcher-like leaves as well as the small normal hoya-like foliage. The morphological meaning of these pitchers has not yet been thoroughly worked out. "The species "of Dischidia all want a careful study. They cannot be described "satisfactorily from dried specimens. The leaves change in form, and "it is not ascertained in respect of many species whether they may or "may not be converted into pitchers (ascidia)." (Hooker in *Flora of British India*). The plant at Kew is now under the special observation of Dr. Scott, Hon. Keeper of the Jodrell Laboratory. *D. bengalensis* is an old garden plant. It is cultivated at Kew in the Palm House. *D. rafflesiana* is for the present kept in one of the propagating pits.

Temperate Ferns.—The collection of ferns in cultivation at Kew is an exceptionally rich one, containing over 2,000 named species and distinct varieties. It is accommodated in the following houses: No. 1, tropical tree ferns; No. 2, tropical ferns and lycopods; No. 3, temperate ferns; the Winter Garden, large tree and other ferns from temperate regions, and the hardy fern rockery. No. 3 house has long been felt to be unsuited for the cultivation of ferns. It was a heavy low-span roofed T shaped structure in part built in 1803. This year it has been pulled down and replaced by a light iron span-roofed house 60 feet long, 23 feet wide, and 13 feet high. It contains a broad central and two side stages with paths on both sides. The old-fashioned belief that ferns require more shade than most plants has given way to the more rational one that ferns under cultivation in the climate of England enjoy plenty of light and rich treatment generally. The best collection of British ferns are grown in rich open borders and treated very much as if they were cabbages.

Xanthorrhœa Tateana, F. V. M.—This grass gum-tree was described by Sir Ferd. Mueller in *Zeitschr. Oesterr. Apoth. Ver.*, 23, 294 (1885). It is a native of Kangaroo Island in South Australia. The Royal Gardens are indebted to Mr. Maurice Holtze, F.L.S., Director of the Botanic Gardens, Adelaide, for two large living stems of this distinct species, which arrived in fine condition on the 8th of October. They are placed in the south end of the Palm House among the large Cycads, and near to the big cactus, *Cereus giganteus*. There are twelve species of *Xanthorrhœa*, all natives of Australia. The other species in cultivation at Kew beside the above are *X. australis*, R.Br.; *X. gracilis*, Endl.; *X. hastilis*, R.Br.; *X. Preissii*, Endl.; *X. quadrangulata*, F.M.; and *X. semiplana*, F.M. Small plants of the last named were received from Mr. Holtze with the stems of *X. tateana.*

A set of Mr. Richard Spruce's "Hepaticæ Amazonicæ et Andinæ" has been purchased. It comprises about 500 species, a very large proportion of which are new, or rather were new, for the published descriptions of them appeared in *Trans. Edinb. Bot. Soc.*, XV. as long ago as 1885. They form part of the very valuable and extensive collections made by Mr. Spruce between 1849 and 1860. The first set of his flowering plants is in the Kew Herbarium.

The last part of Hooker's "Icones Plantarum" (part 2, vol. iii. of the Fourth Series) contains figures of many interesting new plants, notably, *Ixora siphonantha*, Oliver, from Madagascar, with flowers nearly 9 inches long; *Polycardia baroniana*, Oliver (Madagascar), a curious *Celastrinea*, with flowers springing from the centre of the leaves; *Macphersonia macrophylla*, Oliver, from the same country, with dense pendant flower-spikes about 18 inches long; *Didymocarpus pectinata*, C. B. Clarke, a singular species with fern-like foliage, from the Malayan peninsula; and *Tetrachondra Hamiltonii*, Petrie, a remarkable new genus from New Zealand, referred to *Boragineæ*, though in habit and appearance it is very unlike any other member of the order. Indeed it is much more like a *Tillæa*, with which it was found growing in flats and river beds.

Chinese Collections of dried plants still furnish a large number of novelties, and Mr. Hemsley has lately published descriptions (*Journ. Linn. Soc.*, XXIX.) of a selection from Mr. A. E. Pratt's fine collection from Western Szechuen. Among them is a very distinct new species of the genus *Oxyria*, of which genus the widely-spread *O. digyna* was the only previously known species.

It is noticed with regret that at a meeting of the Committee of the Agri.-Horticultural Society of Madras, held on the 1st August last, it was resolved "that the establishment must be reduced in view of "the financial condition of the Society, and that accordingly three "months' notice be given to Mr. J. M. Gleeson, Superintendent of the "Society's Gardens." Mr. Gleeson has been in charge of these gardens since April 1883. He is described by Mr. Joseph Steavenson, the late Honorary Secretary, as an "able and efficient superintendent, always on "duty and scrupulously honest. His horticultural and arboricultural "skill is as much above that of those of his predecessors I have known, "as his experience is wider and his botanical attainments are higher." Mr. Gleeson was formerly trained at Kew, and his extensive knowledge and experience of Indian horticulture should render him a valuable officer to take charge of gardening operations in the East.

ROYAL GARDENS, KEW.

# BULLETIN

OF

# MISCELLANEOUS INFORMATION.

No. 72.] DECEMBER. [1892.

## CCLXXXII.—DISAPPEARANCE OF DESERT PLANTS IN EGYPT.

Kew is indebted to Mr. E. A. Floyer, F.L.S., Inspector-General of Egyptian Telegraphs, for the following interesting memorandum on the causes of the disappearance of the arboreal desert vegetation of Egypt within historic times. It is an extract from the report (which will be published in French by the Egyptian Government) of the expedition despatched by the Khedive in 1891 to the country between the Nile and the Red Sea. The paper has a wider importance from the fact pointed out by the author that the theory he propounds "is " applicable to all countries where soil and climate are fit to produce " wild shrubs, but not fit to support cultivation":—

### Disappearance of Desert Plants in Egypt.

Much attention was paid by the expedition to the botany of the valleys and deserts, but great pains were not expended in the collection of herbarium specimens. After the patient labour extending over more than 20 years of Ascherson and Schweinfurth, there was little chance of finding new specimens, even though the country explored had, in some part, been left unvisited by these eminent botanists. The score or so of plants which seemed unfamiliar where all identified by Mr. W. Carruthers, F.R.S., with those in the *Flora Ægyptiaca*. The collection of a herbarium was neglected, and attention was directed to another point.

A main geographical feature of the country is a ridge some 2,000 feet high with peaks reaching 6,000 feet above the level of the sea. And this ridge runs near the coast, sloping steeply on the seaward side and gently on the landward side. The very marked difference in the conditions on either side of the watershed seemed to offer opportunities for discovery.

It seemed that the steep and comparatively moist slopes on the east might support a vegetation different from that which struggled for existence on the drier western slopes. Such should have been the case. And the fact that it is not the case gave the clue to the theory in the present paper.

It is true that *Calligonum comosum* will be mostly found in the east, that *Tamarix* indicated a limestone formation, and that *Capparis spinosa* is rarely found except in the crevices of granite rock; but there seems evidence that some universal levelling influence has been at work, which has reduced both landward and seaward slopes to a uniform condition.

In the pastoral East botany has a wider significance and is a broader study than is fulfilled by the collection of specimens or observation of localities. It is, among the Arabs, the first thing carefully studied and known. It means the safety or destruction of their flocks. These will seem to be fair statements and free from exaggeration when the following facts are considered.

Schweinfurth gives some 2,000 species of plants as found in Egypt. Many of these are cultivated in gardens. Putting those aside there remains not a shrub or grass which has not its Arab name duly tabulated in Schweinfurth's lists. It is true that sometimes one Arab name serves for three or four varieties of the same plant. But this hardly creates confusion, and occurs less often than would be supposed probable.

Schweinfurth has tabulated over a thousand names given by the Arabs to the scanty shrubs scattered over their plains, and the esteem with which he is received amongst these people as a "writer of trees" is far higher than that accorded to those who study temples and ruins.

In the valleys of the Northern Etbai, as the natives call the country, a little boy will readily name nearly all the plants which can be shown him. True it is all the knowledge he has. From the day he can walk he goes out with the flocks, and his alphabet is the names of the shrubs on which they feed. When he grows older he follows camels, and takes a wider range geographically and learns a different class of shrubs. Presently he begins to travel, and learns geography, and he becomes an excellent geographer. To the botanical names already acquired, he adds names for granite, sandstone, limestone, slate, quartz, mica, and metamorphic rock, all of which he learns to distinguish without error, and then his equipment is complete; and, if the words he knows could be classified, it is probable that some 50 per cent. would be found to be botanical terms.

His geography is composed of five names for hills of different size and shape, and four names for valleys and ravines; and a hill lofty enough to receive the name Jebel has always a Wadi of the same name, and the hill is generally called after the valley, and the valley is called after the principal tree which grows, or which, when the name was given, grew along its course. So far is the geography connected with the botany.

In the nomenclature of the valleys another curious thing is remarked; in hardly one valley is there found the tree from which that valley takes its name. There are none of the fragrant blossomed *Moringa aptera* in the Wady Miah.

There is no *Crotalaria* in the Wadi Natash, no *Acacia tortilis* in the Wadi Arreis, no *Acacia spirocarpa* in the Wadi Somr, no *Tabernæmontana* in the Wadi Lehana. This last is an Abyssinian name. And it must be remembered that Arabic has only been spoken in these mountains for the last 1,200 years. The Rabia' Arabs who came here with the conquering 'Amr in the year 640 intermarried with the Hamitic shepherds who wandered from Massowa to Kossair. These Hamitic shepherds were known to the Nile dwellers by the generic name of Beja, a word which it seems probable is the Kensi word for "outsiders." They were "outsiders" to those dwelling in the Nile Valley.

The most northerly subtribe of the Beja were the Bishari who spoke and still speak Bishari, a language allied to Abyssinian. From the intermarriage of the Rabia' and the Bishari sprang the Abbadi (plural Ababde) who now inhabit the northern Etbai, and in whom the Semitic element is far stronger than the Bishari, a race still found in great numbers to the south. The predominance of the Semitic element may be traced in the gradual disappearance of Hamitic names for the hills and valleys. The Arab historians, writing in 800, call the mountain south of the emerald mines Karkashendah. To-day it is called by the Arabic name of Hamata (*Ficus pseudosycomorus*), an allusion to its shape. And Wadi Lehana the Valley of the *Tabernæmontana*, an Abyssinian tree, is another survival from pre-islamic days.

Where these valleys run though the soft sandstone there are, at intervals shade-giving boulders, which from time immemorial have been used as resting places for travellers. These rocks are scored everywhere with rude pictures of cows, of horses, of bowmen, and of long lines of ostriches. These animals have all disappeared. We know from history that bodies of cavalry from three to five hundred in number ranged these deserts for months without commissariat difficulties. This would be quite impossible now. A great change has come over the country, and it is a change which has affected equally both sides of the watershed.

It is not a question of geological epochs; it is a question merely of hundreds of years. So far as concerns the disappearance from these valleys of trees whose names are still known in a language and to a people who only reached these valleys 1,200 years ago, there may or may not have been a period of rain greater than at present. On this point, which is of the hignest interest, Schweinfurth gives a guarded opinion. When comparing the flat and barren plains on the west with the scored and comparatively well-shrubbed valleys on the east of the Nile, he asks whether the flatness and barrenness on the west is the cause or the effect of altered meteorological conditions. And speaking of the Eastern Desert, he says, "I incline rather to the latter supposi-" tion, because in all my travels in the desert I never could persuade " myself that changes of climate have occurred in the last epoch, and " still less in the historical times. I rather think that Egypt in the " old times of its history did not enjoy a better climate than at present. " . . . . And I have abundant proofs to explain the phenomenon " of erosions exclusively as results of water, wind, and general " atmospheric influences." In a paper read before the Geological Society of London it was shown, as far as might be, that there was nothing to indicate a pluvial epoch. It was shown that the erosion in the plains was nearly as great as the erosion in the valleys; that atmospheric action was nearly as great as the action of combined wind and water. After all that has been said there is room for discussion about a pluvial epoch. But the disappearance of the animals who formerly dwelt here, and of the plants on which they lived, is shown to be a matter of merely 1,200 years by the fact that the names of the lost plants and animals remain in a language which has only been here during that period. And if this wholesale change can be traced home to its cause, beyond any doubt it will form a valuable contribution to botany, and can be invoked over large areas by botanists to explain, for example, the disappearance of the frankincense and spices from Southern Arabia, to explain the thousands of chariots and horsemen in Palestine, and to explain how in early times a greater fertility and population existed in many countries whose history like that of Palestine seems out of proportion to its present circumstances.

It has been stated provisionally that the Arabs entered the country with the conquest of Islam in 640 A.D. Long before this date there was among the Egyptians a strong admixture of the Semitic element. But for the purposes of the present argument this date is selected as the right one on the following grounds. The Arabs of the conquest were the nomad camel-owning Arabs. It was their establishment in the Nile Valley that permitted the camel to make with safety another stage in its advance to the west.

The camel is a peculiar property. It is very valuable and it cannot be protected. It must range in safety over a vast area. It is at once the safety and the Achilles tendon of the tribe who own it. While peace reigns it both feeds and transports its owner to fresh pastures. But in war a handful of men may remove the entire herd. Thus, so long as in the Nile Valley the Arabs were accounted "the accursed Shasu" so long was the camel restrained within the limits of Palestine and Arabia. True, the camel was used in the time of Ptolemy Philadelphus to bring merchandise across the Kina-Kosair road. But a small number of camels could carry all the Indian trade of those times. The journey takes four days. Ten camels making one complete journey each fortnight would in a year bring 40 tons of merchandise; by the Coptos Berenice route perhaps half this amount. This seems an excessive estimate for the weight of the Indian trade considering the small bulk of such articles as could pay for the long transport from India. Compare the lists pompously inscribed on stone of the articles obtained by a Pharaoh in his most glorious campaign. Nor were camels alone employed; the ass long maintained his place as the cheapest transport, and to this day donkeys are used nearly as often as camels on this trade route.

The camel master who should approach the Nile with a freight of valuable goods could at least obtain a safe retreat. The merchant who could not ensure him this could hire no camels. Since A.D. 640 the wealthy camel owners are seated on the Nile. Their camels graze in security over the now impoverished deserts. But before that time they could not spread over the country at will. They could find no long period of security. It seems probable that for purposes of transport a few old camels were brought over by hardy men willing to fight in their defence, but the stud camels remained always in Arabia.

The researches of Ritter on the gradual spread of the camel from its home in Central Asia seem to exhaust all that is known on the subject. Nor is there anything in his learned arguments in contradiction of the above passages which were written before reference could be made to the "Erdkunde von Asien." A long personal acquaintance with the camel and his Arab (and this order is used advisedly) brings one to the same conclusion as a study of the Bible, of the Egyptian monuments, of the Greek and Roman biographers and of Josephus has brought the learned scholars whose verdict is summed up by Ritter in the following general terms:—

> The camel was not introduced into Egypt so as to breed until a period which may have been even post-muhammadan. Its absence from the monuments* shows that the Egyptians never bred it in Pharaonic times.

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* It is perhaps more curious than important that the Arab word of command to a camel to kneel, "barrak," is the same as the hieroglyphic "abraka," to kneel before a god in adoration.

In the time of the Ptolemies the camel route between the Red Sea and the Nile was used by Arab camel drivers with their beasts from Arabia. And a region south of Meroe appears to have been occupied by camel Arabs. In the fourth century A.D. for the second or third time the animal was re-introduced by the Saracens. In all cases its introduction was by the Berenice-Coptos or neighbouring Red Sea Nile routes.

The introduction of the camel in the fourth century rests on the authority of unequal value of Ammianus Marcellinus. It would appear, however, to refer to such supply as might afford transport on the Berenice-Coptos road, and the opinion may remain unaffected that they only bred in Egypt when their masters were seated as conquerors in the Nile Valley.

Thus far what was fairly possible has been put forward in support of the theory that the camel and his Arab were not domesticated in the country until A.D. 640, or some 1,200 years ago.

I have seen nowhere expressed what is according to my experience the relation between the Arab, his wife, and his camel. In most cases the camel belongs to the women, and the man is the camel's herdsman. In Arabia more than in other countries important affairs are in the hands of women. In countries where a premium is awarded to inventive capacity the position may be reversed, but in Arabia, where nothing is invented, a great man is one who has married many camel-owning women.

It does seem very probable that when Islam arrived the valleys were full of the trees from which the Arabs gave them their names. It remains to apportion to the camel and to the Arab his share in the destruction of these trees. For while the camel eats the leaves and shoots, the Arab converts into charcoal the stem, root, and branch.

I incline to state the matter thus:—

So long as the valleys were all the Arab had to depend on for feeding his camels, so long he preserved his trees for his camels. But by degrees some Arabs got a footing in the Nile Valley. They hired their camels to the farmers to carry their harvest. They went back to their deserted valley and brought away the trees in form of charcoal. I think the charcoal making is an industry recent in this country. It does seem impossible to find out in history when charcoal was first known in the East. It is not possible to say that the words in use for it meant charcoal as distinct from burning wood; and the same difficulty occurs in other Eastern languages. But it is probable that the root-meaning is "black," and that charcoal-making in Semitic lands dates from prehistoric times; and for its introduction into Egypt one can only put forth the opinion based on the absence from the Nile Valley of suitable wood.

It is only the various acacias which furnish charcoal, but their disappearance drives the camel to the other shrubs. These are soon grazed as far as may be when the Arab comes with his axe and chops down the loftier boughs. Only certain trees will support, in that dry land, the continual removal of every leaf. Thus near Sighdit are mournful clusters of bare *Balanites* trunks, but every one of the Mai or *Moringa aptera* trees from which the valley takes its name has disappeared. Both *Moringa aptera* and *Balanites* form excellent camel fodder. The principal trees in the valleys of the Etbai are the acacias. Sometimes, for two or three miles a valley will show 50 or 60 well grown acacias to the mile. The proportion they bear to others may be stated nearly as follows :—

| | |
|---|---|
| *Acacia Seyal* - - - - - | 60 |
| „ *tortilis* - - - - - | 20 |

| | |
|---|---|
| Other kinds | 10 |
| *Balanites* | 2 |
| *Moringa* | 2 |
| *Leptadenia* | 4 |
| *Calligonum* | 2 |

Of the smaller camel fodder the *Basella* hardly nourishes by itself, nor do the *Panicum*, the *Crotalaria*, nor indeed any of the smaller plants. Just as grazing will not profit the Baluchi camel unless the *Salicornia* be present, so the grazing without *Acacia* is small advantage to the Arab camel.

A description of what is going on to-day will serve probably as a true description of what has been going on intermittently for 1,200 years. The process has been arrested from time to time during periods when the Nile Valley was not safe for Arabs. And it is possible that the prosperity in Egypt in which all Englishmen are rejoicing may seal the destruction of the remaining trees, and leave the country bare save of *Calotropis prôcera* and the plants which nourish a few sheep and donkeys, attended by herdsmen, fed by grain from the Nile Valley. The camel will then, having so to speak burnt its boats, be domesticated in the Nile Valley. And it is interesting to speculate as to how he will develop there. Already the massive Cairo camel is a type distinct from other camels, surpassing all in its cumbrous massive proportions.

In 1850 Bellefonds travelling in the country between Assuan and Abu Hammad wrote:—"There were grouped around us in the "ravines many men, women, and children. All begged us not to cut "their trees which were their sole riches. But in reality they were "only come to beg." Here I think Bellefonds misunderstood the situation. No doubt his men had cut down many branches to feed his camels and the request was genuine. To myself such requests were frequently urged, and to my camel men, also from whom no alms were expected, and who always forebore to cut when asked.

In a valley full of acacias there hangs at frequent intervals a long crook, peeled that it may readily be seen. The children, followed by their flocks, employ the crooks to shake the leaves down. One tree will feed two sheep and continue to thrive. And a man with an axe will destroy in a few minutes, as a meal for one camel, what would have supported two sheep for a year. Colston, in 1878, writes of the Wadi Huda:—"It was the first of these rich and verdant valleys which we "met with afterwards continuously during the great part of our "journey. This Wadi was full of trees, principally of the acacia kind, "called by the Arabs seyyal. We found there also a great quantity of "shrubs and plants of different kinds, among which was a kind of "broom called murkh (*Leptadenia pyrotechnica*)." In 1891 this valley contained but a few *Calotropis*, eatable by no animal, and some mangled stumps of acacias ready for the charcoal burner.

A ride up the Wadi Hullus affords perhaps the most instructive example of the process of destruction. The word "hullus" means a cloth or felt spread over a camel's back. And the valley is a curious trough running along the apex of the long ridge from Hullus to Wadi Jemal. The origin of the name is thus apparent.

On leaving the Wadi Durunkat we entered the Hullus, and rode for some miles through clusters of mangled acacia stumps. The owner of the sheep, which must shortly move elsewhere, was settled in the Nile valley. Presently we crossed a line across the path, a mere scrape of the hand in the soft soil. From this point fine umbrageous trees stood thick in the valley. Right at the highest point was camped an old

patriarch with large and well-fed herds. Here we might not cut trees. The patriach's hospitality was confined to letting our camels eat what they could reach without help of axe Only as a concession to the stranger we might with the crooks bend down boughs and hold them while the camel fed. This old man was, in Arab parlance, "kerhan," that is, an hermit from the Nile. He and his forefathers had for generations lived here. It was one of their many valleys, the one in which the water supply lasted longest. When the rains fell he spread abroad into other valleys, leaving this one to grow against the time when he should by drought be driven to return to it. But his offspring had fallen few, and the lower part of the valley had been taken by a family whose roots were in the Nile Valley.

To sum up all the facts which I have urged in the preceding pages. It seems clear that in the camel nature has created a Frankenstein which in this country is gradually devouring her. And it seems that what is applicable to this country is applicable to all countries where soil and climate are fit to produce wild shrubs but not fit to support cultivation. It seems that Nature is being slowly but surely beaten by the camel and his inevitable but improvident companion the axe. Nature fights hard. This year copious rains have fallen in the mountains, but the reply of the Arab is to send for grazing a correspondingly larger number of camels. And it seems clear that a long period of tranquillity on the Nile will so far aid the Arabs that the sheep and goat must follow the ostrich, wild ass, and cow, and the *Balanites* follow the Lebana or *Tabernæmontana*.

There is more truth than appears at first sight in the story told by the Arabs to travellers in Palestine. They say, and they generally say it as a joke, that there were formerly lions in Palestine, and that they were frightened away by the camel. It is probable that the camel has expelled the lion from Palestine, not by roaring, but by consuming the shrubs which supported the lion's prey.

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## CCLXXXIII.—TAJ GARDENS, AGRA.

The Taj Mahal or commonly the Taj at Agra is described in the *Imperial Gazetteer of India* "as the most exquisite piece of Muhammadan architecture in the world." It rises with its beautiful domes, "a dream in marble" on the banks of the great waterway of the River Jumna. The Taj was erected as a mausoleum for the remains of Arjamand Benu Begam, wife of the Emperor Shah Jahan and completed in 1648. The materials are white marble from Jaipur and red sandstone from Fatehpur Sikri. The complexity of its designs and the delicate intricacy of the workmanship baffle description. The mausoleum, a square of 186 feet, stands on a raised marble platform at each of whose corners rises a tall and slender minaret of graceful proportions. Beneath the great dome an enclosure of marble trellis-work surrounds the tombs of the princess and of her husband the Emperor.

"The Taj represents the most highly elaborated stage of ornamentation reached by the Indo-Muhammadan builders, the stage at which the architect ends and the jeweller begins . . .

"From the pillared pavilions a magnificent view is obtained of the Taj gardens below, with the noble Jumna river at the further end and the city and fort of Agra in the distance."

A painting of the Taj with its gardens is included in Miss North's gallery at Kew, No. 228.

As might naturally be supposed the Taj gardens are probably the best known and most visited in India. The superintendent has charge also of the Sikandra, Itmaduddaula, and Rambagh gardens and of the Exotic Nursery. Besides this he has the work of watching the condition of the buildings at those places. On the retirement of the late incumbent the Government of India, on the nomination of Kew, appointed Mr. Alexander Bremner Westland, late Assistant to the Superintendent of the Botanical Department at Hong Kong, to the post. Mr. Westland arrived at Agra in November 1891.

The following report was addressed to the Government of the North-west Provinces, in continuation of a memorandum by the Commissioner, dated the 16th January 1891 :—

(1.) The memo. in question describes the existing condition of the gardens and refers to two main points (1) the determining some general scheme to govern the future arrangement of the gardens ; (2) the application of electric light to the gardens and buildings, with which also was connected (it being proposed to use one set of machinery for both purposes) the project of watering the gardens by steam. Number *two* has been absolutely disposed of in both branches. Under G. O. No. $\frac{51}{\text{XII-438B}}$, of 12th January 1892, the electric project has been abandoned, as I (for my part) hope never to be revived ; and the recently constructed Agra waterworks will, it is believed in the near future, supply the gardens without any separate engine in the vicinity being required.

(2) There remains the first point. The gardens have been several times inspected by Mr. Ridley from Lucknow, by Mr. Phillips from Allahabad, and by several other experts. Mr. A. B. Westland, the Superintendent appointed from Kew Gardens, who has had some years experience in Hong Kong, arrived in November last. He has very properly waited to see the effects of the hot weather and has made some experiments in trimming and re-adjusting certain portions of the gardens. The joint report prepared by Messrs. Ridley and Phillips, dated 1st May 1891, has also been read. The conclusions finally arrived at are those given below in the resolutions of the Committee of the 1st June 1892 ; they are founded on a very full detailed report by Mr. Westland circulated in the preceding month.

(3.) In sum these conclusions are as follows :—In the centre avenue the existing medley of shrubs on each side of the canal is unsightly, and should be replaced by turf arranged so as to disclose the stone geometrical scrolls forming the beds, with only one or two low palms in the centre of each. This will throw out the tomb in relief and harmonise with the general character of repose which the tomb inspires.

(*a.*) The line of cypresses is to be maintained. The lofty trees (principally *Mimusops*) forming the main avenue from gate to tomb were (as described in the memo) nearly all removed in 1890. The design now is to replace them by fewer trees less lofty and less numerous and varying in each case with the trees in the adjacent plot. The few *Mimusops* still left will not be removed, but their places filled in when necessary as above. The intervals between these trees in the avenue will be filled by a border of shrubs of different kinds carefully grouped; not too high nor too continuous but allowing

glimpses through them of the interior garden plots and the walls. The walks in the garden plots (Nos. 1 to 18) will not be in irregular curves but of geometrical pattern, in several there will be no walks at all.

(*b.*) There will be fewer rose-beds, but it is hoped of a better class.

(*c.*) The fern house will be removed to a more distant site; it is incongruous with its present surroundings. In one or two of the garden plots now quite denuded of trees a few and only a few trees will be planted. As a matter of course, old and useless timber and self sown trees will be removed. The turf of the grass plots will be renewed and existing plants carefully watched and trimmed. It is Mr. Westland's opinion that the variety of the *flora* in the gardens is very rich, and ample for all purposes.

(4.) The details of the proposed work are added in the resolutions cited below [not printed]. The key to these proposals will be found in the Commissioner's note of 22nd of March last.

(5.) The general aspect of the Taj is a subject which transcends dry official statement, but perhaps this much, may here be said. Its peculiar beauty strikes the imagination as possessing at once an air of other worlds remoteness, and yet of solid immobility; the secret possibly being that the design is refined but lacks variety, while the workmanship throughout is exquisite and in exquisite material. The trees and foliage, which form a vestibule before the tomb, here breaking up and there framing the general outline, contribute to heighten and repeat its pure aspiring tone. They do grateful service, provided only that their luxuriance be restrained and that no stiff nor continuous screen be allowed to grow up.

(6.) The Committee, without pretending to any supremacy in taste, have endeavoured to work in accordance with the requirements of the place. What they have now determined has at least this merit, that it destroys or produces nothing which cannot speedily be replaced or altered, should results ultimately prove disappointing. Their aim is to maintain the buildings mantled with a due amount of foliage not too lofty nor massive; and to keep the garden-plots somewhat formal in character; green lawns with shrubs or palms being deemed more congruous than variegated flowers or abundance of roses.

They are glad to add that the present superintendent, Mr. Westland, evinces a genuine and intelligent interest in the adaptation of the gardens, and has made many valuable suggestions and improvements.

## Note by Commissioner, dated the 22nd March 1892.

H.H. the Lieutenant-Governor visited the gardens on the 22nd March with me and the superintendent, the general system of laying out the gardens was again discussed.

It was agreed that the superintendent's proposal to grass the geometrical scrolled beds on each side of the water and plant in the centre a line of *Cycas* should be adopted. This plan has, in fact, already met with universal approval.

As to the cutting down the outer borders (which are at present of *Duranta* about 5 or 6 feet high) and re-modelling the plots with winding walks, his Honour expressed what is certainly my own view, and that I think of the Committee also, namely, that a certain stiffness and primness of style of gardening befit the place. Individually I go

further than this. I dislike the winding walks, and I think the borders should not be cut away, but merely reduced in places so as to give glimpses and not more than glimpses of the interior plots. The tall trees cut down by Mr. Finlay on the east side should also be replaced at proper intervals; but whether with *Eucalyptus Globulus* or some more suitable eastern tree is a question.

It is not, in my opinion, æsthetically correct that the Taj, the whole Taj, and nothing but the Taj should strike the eye from every quarter. The builders idea, I believe, to have been that this and similar palaces and tombs should be visible through long *vistas* of heavy and narrowly divided foliage, so that height, distance, and the charm of the unknown might be communicated to them. If you see them fully exposed at once to view, with only a series of devious gravel walks and multiform beds in the intervening space, there is nothing left to the imagination; and the spectator soon begins to believe that there is little difference between this and a thousand other flower gardens in all parts of the world.

(Signed) W. E. Neale,
Commissioner.

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## CCLXXXIV.—INDIAN GUTTA-PERCHA.

The natural sources of supply of gutta-percha, and the possibility of their exhaustion were referred to in the Kew Reports 1876 (p. 23); 1887 (pp, 30, 31); and 1881 (pp. 38–45). A few trees, natives of the Indian peninsula, yield substances more or less similar to gutta-percha. One of these is *Dichopsis elliptica*, Dalz. (=Bassia elliptica, Isonandra acuminata).

The following note on this plant appeared in the *Report of the Royal Gardens, Kew*, 1881, p. 44:—

"This tree appears to be common on the Malabar coast, the forests of Coorg, the Wynaad, Travancore, &c. It grows to a height of 80 or 90 feet. A substance similar to the gutta-percha of commerce. is procured by tapping, but the tree requires an interval of rest of some hours, or even of days, after frequent incision. In five or six hours upwards of 1½ lbs. was collected from four or five incisions. The gum is hard and brittle at the ordinary temperature, but becomes sticky and viscid on the increase of heat. It is not found applicable to all the purposes for which gutta-percha is used, but 20 or 30 per cent. of it may be mixed with gutta-percha without destroying its qualities."

The same tree is referred to in Watt's *Dictionary of the Economic products of India*, Vol. III., p. 102. In this, an extract taken from *Drury's Useful Plants of India*, suggests that the gum might be usefully utilised as a sub-aqueous cement or glue; or that on account of its perfume when heated, it might possibly be rendered of some value to the pastille and incense makers. More recently this gum has been analysed by Mr. David Hooper, F.C.S., F.I.C., Quinologist to the Government of Madras, and the results are given in the Annual Report of the Cinchona Plantations of Madras for 1891, p. 18:—

"*Indian Gutta-Percha.*—An abundance of gutta-percha milk has been yielded during the past dry weather in the Wynád by the Panchotee

tree (*Dichopsis elliptica*), and some planters have been asking for information on the subject, and inquiring whether it could be made into a commercial article. The milk has been known for some years to afford what was called Indian gutta-percha or Pala-gum, and has been used as an adulterant of Singapore gutta. General Cullen brought it to notice 35 years ago, and Dr. Cleghorn published a memorandum on the subject at the time. It was reported upon by experts in London, who found that it was unfit for water-proofing purposes, as its solution in coal-tar and turpentine dry up to such a brittle consistence that the fabric is useless. It could be used as a birdlime or cement, and keeps well under water, as a cable insulator, especially if mixed with some genuine gutta. By boiling the milk of the Panchotee tree, a white mass separates, which can be kneaded by the fingers, but which becomes hard and brittle when cold. The brittle character of this substance I find is due to a large proportion of a crystalline substance found also in true gutta, and called crystalban or alban. Crystalban, according to Payen, occurs to the extent of 14 to 19 per cent. in the best kinds of gutta-percha, but I have extracted as much as 69·2 per cent. of crystalban from the dried secretion obtained from Wynád. The presence of a large quantity of crystals in this gum, of course, would interfere with its utility, but crystalban is easily removed by boiling alcohol, and the residue consists of a very good and pure gutta-percha. I cannot see why this process could not be used to purify the Indian gum and so obtain an article similar to the Malayan article."

A note on a gum from a closely allied plant (*Dichopsis obovata*, C. B. Clarke) received at Kew from Burma appeared in the *Kew Bulletin*, 1892, p. 215.

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## CCLXXXV.—GOLD COAST BOTANICAL STATION.

The establishment of a botanical station at Aburi, a hill village in the colony of the Gold Coast, was noticed in the *Kew Bulletin* for July 1891, p. 169. This station continues to be carried on with considerable success. It has received throughout the warm support and the personal interest of the Governor, his Excellency Sir William Brandford Griffith, K.C.M.G., and its mission of usefulness in the colony is becoming more and more appreciated. The following correspondence, with a copy of the last annual report on the work of the station for the period ended the 30th June last, has recently been communicated to Kew by the Secretary of State for the Colonies:—

Colonial Office to Royal Gardens, Kew.

Sir, Downing Street, 15th October 1892.

I am directed by the Marquess of Ripon to transmit to you, for your information, a copy of a despatch from the Governor of the Gold Coast, enclosing a report on the progress and condition of the Botanical Station at Aburi for the period ended 30th June 1892.

I am, &c.
(Signed) John Bramston.

The Director,
Royal Gardens, Kew.

The GOVERNOR of the GOLD COAST to COLONIAL OFFICE.

Government House, Christiansborg Castle, Accra,
MY LORD, 9th September 1892.

IN continuation of my despatch, No. 37, of the 11th February, I have the honour to transmit, for your Lordship's information, copy of a "Report on the progress and condition of the Botanical Station at "Aburi, for the period ending 30th June 1892," which has been received from Mr. Crowther, the Curator of the station.

2. The report is both interesting and satisfactory, and the fact that the public are taking an interest in the educational work which the establishment of the Botanical Station was intended to promote is shown by the quantity of seedlings of Liberian coffee, and fruit and other plants, which were sold during the half year, and produced a sum of 51*l*. 8*s*. 6*d*.

3. Irrespective of the purchase of plants, I am informed by Dr. Easmon, who takes great interest in the work of the station, and also by many native gentlemen, that the people are imitating what they see of the system of cultivation at Aburi as to the preparation of land for plants, the due distances of these from each other so as to admit of ventilation and a fair area of soil for the root support of each plant, keeping the land free from weeds, and attending to it as they have never done before. Even as regards the culture of that most valuable vegetable and fruit, the plantain, the people are thinning out the mass of trees which grow in wild luxuriance, but which from their overcrowded state produce only poor and insignificant bunches, leaving clumps of "trees," as they are called, at greater distances from each other than heretofore, and diminishing the number of plants in them, with the result that those remaining become vigorous and robust, and produce finer bunches.

4. The tank at Aburi, the erection of which your Lordship was pleased to sanction, and which is capable of storing 100,000 gallons of rain-water, has been of invaluable service to the station. It was completed before the early rains began in April, and quickly received as much water as filled it to the depth of 8 feet 5 inches, equal to about 60,000 gallons of water. Since the 8th of June up to a fortnight ago, when $\frac{12}{100}$ths of an inch of rain fell, neither at Aburi nor Accra has there been a drop of rain, so that without the water from the tank at Aburi to support them the young plants would have suffered very much, indeed those of a more delicate nature than others, particularly cacao, would have died.

5. My visit to the Krobo countries between the 17th and 30th of July last gave me an opportunity of observing the excellent work Mr. Crowther has been carrying out. The place seemed as if transformed since my visit to it in March and April. The frontage land was artistically laid out in beds and walks, and planted with flowers and shrubs, besides being a nursery for Eucalypti, Beefwood, Shea butter, Kola nut and other valuable plants. A patch of about an eighth of an acre of land was under the most luxuriant growth of Annatto, the stem of each shrub bending under the weight of a cluster of seeds nearly as large as one's fist. The soil seems admirably adapted for the cultivation of this plant.

6. Young seedlings of the Royal Palm (*Oreodoxa regia*), which appears to be unknown on the Gold Coast, and of the Cocoa-nut palm, have been planted at suitable distances on what I may term the frontier land of the station, and in one or two instances in avenues within the plantation.

In a few years they will add wonderfully to the natural beauty and attractiveness of the place.

7. The Government is greatly indebted to Mr. Thiselton-Dyer, C.M.G., the Director of the Royal Gardens at Kew, and to his able assistant, Mr. Morris, for the kind, continuous and invaluable support they have given to the Botanical Station at Aburi by gifts of valuable plants; and especially by the selection of Mr. William Crowther for the post of Curator at Aburi. Mr. Crowther has proved himself admirably fitted for the duties devolving upon him, and his courtesy and attention to visitors to Aburi has gained for him the esteem and goodwill of all who for purposes of health or curiosity have resorted to his station.

8. For various reasons I am of opinion that it would be of a considerable advantage to the colony as well as to the Curator if he had an opportunity afforded to him of visiting Botanical Stations in other tropical countries, say the West Indies, so as to compare the system he pursues at Aburi with the systems obtaining in those countries; and I propose to do myself the honour at a later date, of submitting my suggestion, with the arrangements which will be required for carrying it out, in a practical shape for, I hope, your Lordship's favourable consideration.

I have, &c.
(Signed) W. BRANDFORD GRIFFITH,
Governor.

The Right Hon. the Lord Knutsford, G.C.M.G.,
&c. &c. &c.

(Enclosure.)

Mr. CROWTHER to the COLONIAL SECRETARY.

Botanical Station, Aburi,
1st September 1892.

SIR,

I HAVE the honour to submit, for the information of his Excellency the Governor, the report on the progress and condition of the Botanical Station at Aburi, for the period ending 30th June 1892, and also to report upon my visit to the coffee and cacao plantations of Messrs. Miller Brothers and others on my return from leave of absence in January last.

2. I regret that there has been so much delay in sending in my reports, but I have had so much work which required my personal attention and supervision that I have experienced a difficulty in sending them in earlier.

3. I arrived at Accra in the R.M.S. "Nubia" on the 8th of January, and immediately proceeded on board the steamship "Kinsembo" to return to Cape Coast, at which place I arrived at 10 p.m. on the 11th instant.

4. On my way to Cape Coast I noticed a small quantity of the Bass fibre being shipped from Appam. This valuable fibre is obtained from the palm which is so common and plentiful in this part of the colony, namely, *Raphia vinifera*. It is a very important product, being worth from 25*l*. to 60*l*. per ton according to quality. Great interest is at present shown in England in the discovery of similar fibres to this, and there is a good market for them, but the supply is very small, owing chiefly, I think, to the difficulty experienced in extracting and cleaning the fibre. It is chiefly used for brushmaking. I will make inquiries and endeavour to obtain information respecting suitable machinery for cleaning and preparing this fibre, which information, if

I am able to procure it, shall be published in my next report. [See *Kew Bulletin*, 1891, p. 1.]

5. On my arrival at Cape Coast I went to see Mr. Batty, Messrs. Miller Brothers and Co.'s agent, who kindly gave me quarters for the night, and the next day I proceeded to Elmina to visit Mr. Hutchinson's coffee plantation.

6. Mr. Hutchinson calculates that he has about 150 acres planted with LIBERIAN COFFEE, and that he has planted out 60,000 plants. The trees are in a very healthy and flourishing condition, and many, which have only been planted a year and a half, are already bearing a very fine crop of coffee. The trees on this plantation are in three stages, viz., 1st, there are a number of trees which were planted in May 1889. These trees are about five and a half feet high, and are compact, bushy plants, bearing a splendid crop of coffee, some of which was ripening at the time of my visit. 2nd. A large area was planted in May 1890; these have grown well and almost all of them are bearing a first crop of coffee. This speaks very well for the suitability of the soil and situation for coffee planting as in Liberia and other places where this variety of coffee is grown, planters never expect the trees to bear until they are three years old. 3rd. The remainder of the trees, which comprise the greater part of the plantation were planted in May of last year, and on the whole are growing satisfactorily. Owing to the excessive dryness of the last season the mortality amongst the plants has been rather excessive, but that can be easily remedied by filling up the vacancies during the coming rainy season with good robust plants.

7. The plantation is in a very creditable and flourishing condition. The work is done by a gang of 70 Krooboys and the land is kept in good order and free from weeds. Mr. Hutchinson seems to thoroughly understand the work, and has every confidence in the ultimate success of the undertaking.

8. The next morning, on my way from Elmina to Messrs. Miller Brothers plantation at Kuby Kul, I was asked to visit a coffee plantation belonging to Mr. Ter Meulen, who accompanied me himself.

9. This plantation is about 25 acres in extent and consists of about 5,000 plants, all of which look very healthy. Many of the trees, which are about three years of age, are bearing an immense crop of coffee and others of two years' growth are also bearing. Mr. Ter Meulen informed me that he had been unable to personally superintend his plantation as much as he would have liked, and consequently it had been rather neglected.

10. After spending an hour or two going over the plantation and directing Mr. Ter Meulen as to the best means of carrying on the work, I proceeded on my way to Messrs. Miller Brothers' plantation at Kuby Kul, where I arrived at 12.30 a.m.

11. Mr. Ter Meulen proposes to extend his coffee plantation very considerably, and is now raising a large quantity of young plants for that purpose. He is very energetic about the matter and very sanguine as to the results.

12. Mr. Batty met me at Kuby Kul, and after resting a short time, I commenced to go over this plantation along with him. I should calculate that the area of this plantation is between 130 and 150 acres in extent. The land is undulating and the soil a black mould and very rich, and I should say remarkably well adapted for the cultivation of coffee and cacao. The trees here are much more luxuriant in growth than those at the other plantations mentioned. This may be accounted for by the extra rainfall and humidity experienced here.

13. Mr. Batty has planted his coffee plants 14 feet apart, which, considering the growth they have already made, does not seem too much. The growth of some of the trees on this plantation is almost incredible. Many of them have grown as much as five feet in one year, and the foliage is of great size and most luxuriant.

14. Besides coffee, Mr. Batty has also planted cacao on an extensive scale. This valuable product seems to thrive equally as well as coffee, the plants which I saw being in a healthy and flourishing condition, especially the ones supplied from the Botanical Station at Aburi during the previous year. The cacao is planted at distances of 13 feet apart and shaded with plantains and bananas, which answer the purpose admirably.

15. Tobacco was also being tried by Mr. Batty. He had about 2,500 plants each of the Havana and Sumatra varieties. They were well-grown plants, with enormous leaves of a good texture, and if the operation of curing has been successful should produce a good marketable article.

16. After my visit to the Cape Coast district I returned to Accra and proceeded to Aburi, where I arrived on the 22nd January.

17. On my arrival I commenced at once to clear the land purchased by the Government from the Rev. A. W. Clerk, and succeeded in clearing the bush from the whole of the 16 acres during the months of February and March. The weather during this period was excessively dry and very suitable for this kind of work.

18. This land, which adjoins the land already possessed by the Government, was covered for the most part with dense bush and large trees, interspersed with a large number of palm trees (*Elæis guineensis*). It is a valuable piece of land, consisting for the most part of a rich black vegetable mould, and free from stones and gravel, with the exception of a small tract of about an acre in extent near the Akropong road, which is rather stony.

19. I have used a part of it as a vegetable garden, and found that potatoes did splendidly, having had a good crop of excellent potatoes from seed which was got out from Messrs. Sutton and Sons, Reading. Corn, cassava, sweet potatoes, &c. have also been planted on this new land. They assist in keeping down the undergrowth and bringing the land under cultivation, and the produce comes in useful for feeding pigs, a good breed of which I brought out from England with me.

20. A small grove of palm trees has been allowed to remain. These I propose to thin out to reasonable distances apart, and clean and trim up the remainder, then run a fence round and allow the pigs to run about in. They will be well protected from the sun, and the palm nuts make very good food.

21. After I had completed the clearing of this land I made a 12 foot road round it, and planted a boundary of cocoanut palms at distances of 25 feet apart. These form an excellent and permanent boundary, and I am pleased to say are all growing well, not one having died through the dry season experienced since they were planted. This boundary of cocoanut palms has been continued around the whole estate, about 300 plants having been planted out in this way.

22. On the land formerly cleared and under cultivation a great amount of work has been done. On my return I noticed that cacao on the land extending from the west end of the house to the town of Aburi had not grown as well as it should have done, and could see that the cause was want of shade. Plants of castor oil (*Ricinus communis*) had been planted, but they had grown up spindly and did not afford sufficient protection, so I have planted bananas and plantains between

the rows of cacao at distances of 12 feet. The whole of this patch, which is about 13 acres in extent, has been planted in this manner, and the plants are now growing satisfactorily.

23. The land in front of the house, and extending to the Akropong road, has been completely planted with Liberian coffee. Also a small plantation of Arabian coffee, consisting of 300 plants, has been laid down. This variety of coffee is grown rather extensively by the natives in this district and thrives extremely well. I obtained the plants from the Rev. A. W. Clerk, in exchange for cacao plants.

24. The avenue of oranges leading to Aburi and as far as the Akropong road has been completely planted with new varieties of oranges, raised from seeds obtained from the West Indies.

25. Besides the work above mentioned a large amount of road making, laying out, and planting has been done. In front of the house a small flower garden has been laid out, which improves the look of the place very much.

26. A path 4 feet wide has been cut from opposite the billiard room door at right angles to the house, and extending 600 feet to where it meets the Aburi road. A small border of flowering plants has been planted on each side. This affords a nearer approach to the house and looks very well.

27. An avenue of ORANGES and CITRON 20 feet wide has been made, which cuts the above-mentioned path near the centre, and extends from the Akropong road, below the police huts, to the road leading to Aburi. It is 700 feet long. The trees are growing well, and will form a splendid avenue in a few years.

28. An avenue of ROYAL PALMS (*Oreodoxa regia*) has been planted at distances of 25 feet apart across the land purchased from the Rev. A. W. Clerk. This avenue extends from the Akropong road near the new house in course of construction by Mr. Clerk, to the western boundary. It is 800 feet long, extending across a level portion of the land. The plants are growing well, and, in a short time, this will make a splendid avenue.

29. Many of these roads have been covered with rubble from the old walls surrounding the enclosure behind the house. This forms excellent material for road making, as it sets hard, and weeds, &c. will not grow in it.

30. The weather for the period under review has not been at all favourable for agricultural purposes. It has been exceptionally dry with a prevailing dry wind, which has been most injurious to plant life. The rainfall for the six months was 25·77 inches, which compared with the corresponding period for the two previous years was very small.

31. The rainfall, besides being so much smaller than in previous years was not so well distributed over the period. The whole of the rainfall in June (3·34 inches) fell in a deluge on the 11th of that month, doing considerable more damage than good, and the whole period has been marked by occasional heavy rains and long intervals of hot and dry weather.

32. The benefit of the new tank which was completed in November last has been felt during the present season. I have no hesitation in saying that half the plants on the station would have succumbed had it not been for the water obtained from this source.

33. As an instance of the amount of water used I may mention that the tank is 80 feet long, 25 feet wide, and 14 feet deep. On the 12th of June, after the heavy rainfall above mentioned, the tank was at its highest, and had 8 feet 5 inches of water in it. On the 28th of the

same month, it had been lowered to 7 feet 3 inches, and on the 5th of July to 6 feet 9 inches. This means a large volume of water, and also a large amount of extra labour for the staff employed.

34. The plants previously planted out have on the whole grown well.

35. Vines.—These have not done so well as I expected. On my return I took out the old soil around the roots for a distance of 3 feet and 2 feet deep, and filled in the space thus made with good soil and compost. I then shaded the plants and watered them well. They made a good growth, and went on well for a month or two, but have again fallen off. No doubt this can be partly accounted for by the extreme dry weather, but I think also that the site and soil is not suitable, and I propose to remove them to another part of the garden, where I trust they will do better.

36. Coffee.—The plants previously planted have grown extremely well, and have a very vigorous and healthy appearance. About 2,500 plants which were planted-out this spring are also growing satisfactorily although they have had to be continually watered on account of the dry season.

37. Cacao.—As I before remarked, this has not done so well on account of lack of shade, and also the dry weather experienced. Now that the matter of shade has been attended to, they are growing better and I hope they will continue so.

38. Annatto (*Bixa Orellana*).—This valuable dye plant seems to have adapted itself well to the soil and situation. It is now producing an abundance of seeds, from which I propose to prepare a sample of "roll" or "flag" annato, when ripe. The colouring matter washed from the seeds, and made into rolls or paste is called "flag" or "roll" annato, and is the best mode of preparing it.

"There is a steady demand for good annato made up into this form, and as the freight and other charges would be less on paste than on seeds there is a distinct inducement to adopt the preparation of paste. While the price of seeds varies from 1¼*d.* to 3*d.* per pound, the price of paste ranges from 6*d.* to 1*s.* 8*d.* per pound, according to quality."

39. Fruit Trees.—The whole of the fruit trees planted are growing satisfactorily. Mangoes, shaddock oranges, sapodillas, avocado pears, star apples, &c., &c., are making fine trees, from which I hope in a short time to obtain fruits. A Loquat tree planted before my arrival has fruited during the present season, and some of the citrons and oranges are showing signs of blossom.

40. Beefwood (*Casuarina equisetifolia*).—A large number of these plants are now raised at Aburi. This tree is stated to possess every property that is usually attributed to the Eucalypti family, and the extensive planting of it would undoubtedly be most beneficial to the colony.

The following plants have been sold from the Botanical Station, viz.:—

| | £ | *s.* | *d.* |
|---|---|---|---|
| Coffee, 12,000 at 1*d.* each - - - | 50 | 0 | 0 |
| Coffee, 110 at 1½*d.* „ - - - | 0 | 13 | 9 |
| Oranges, 32 at 1½*d.* „ - - - | 0 | 4 | 0 |
| Lemons, 3 at 3*d.* „ - - - | 0 | 0 | 9 |
| Cocoa, 40 at 3*d.* „ - - - | 0 | 10 | 0 |
| | £51 | 8 | 6 |

* * * * *

42. Cacao plants were also exchanged for 300 plants of Arabian coffee, and several plants have also been distributed free.

43. The following plants and seeds have been received during the half year. [Here follows lists, not reproduced, of 40 plants and nine lots of seeds received from the Botanical Gardens, Trinidad ; of vine cuttings and numerous seeds received from the Royal Gardens, Kew ; and seeds received from his Excellency the Governor.]

46. Vegetables.—The growing of European vegetables has not been so successful during the present season as it was last year. The weather has not been suitable, and further I find, that the seeds obtained this year were not so good as formerly, many of them not germinating at all. Potatoes, peas, and French beans have grown the best. Potatoes grown from sets obtained from Messrs. Sutton's and Sons, Reading, did very well indeed. The varieties grown were Magnum Bonum, Beauty of Hebron and Sutton's Abundance. The latter variety produced the finest crop of potatoes. Many new vegetables are being tried, as for instance, Globe artichokes, Asparagus, Seakale, &c., &c., and so far they are growing satisfactorily.

* * * * *

I have, &c.
(Signed) W. Crowther,
Curator.

The Hon. the
Colonial Secretary, Victoriaborg.

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## CCLXXXVI.—RAMIE MACHINE TRIALS AT NEW ORLEANS.

The latest information connected with the extraction of fibre from Ramie (*Boehmeria nivea*, Hk. and *Boehmeria nivea* var. *tenacissima*, Gaud.) is contained in a Report on the recent trials of Ramie decorticating machines held under the authority of the U.S. Department of Agriculture at New Orleans. The trials took place on the 30th September last, and the Report of the Board of Experts, acting as jury, has just been published.*

The results of the New Orleans trials do not appear to carry us any nearer to the solution of the problem that has been so long under consideration in regard to the extraction of Ramie fibre. The machines presented do not appear to possess any advantages over those tried at Paris in 1888 and 1889, and fully discussed in the *Kew Bulletin*, 1888, p. 273, and 1889, p. 268,—while they are apparently inferior to the machines tried also at Paris under the auspices of the *Société des Agriculteurs de France* in September 1891.

The following extracts are taken from the United States Report:—

### Machines Entered.

"The official trials of Ramie machines, under the auspices of the office of fibre investigations of the U.S. Department of Agriculture, set for the last week in September at Audubon Park, New Orleans, came off on the 30th of September, and included trials upon jute stalks as well as upon stalks of Ramie.

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* The United States Department of Agriculture. Division of Statistics. New Series: Report No. 99, September and October 1892. Washington Government Printing Office, pp. 347–354.

"Three machines were entered for trial as follows :—The Kauffman machine, by the Kauffman Fibre Company of New Orleans, La.; the Felix Fremerey Decorticator, by the Felix Fremerey Decorticator Company, of Galveston, Texas; the Fibre Delignating machine (known as the J. J. Green machine) of the United States Fibre Company of Versailles, Ky.

"*The Kauffman machine.*—According to the entry of this machine it requires 15-horse power; it works upon green stalks stripped of leaves and upon dried stalks. Four attendants are required to run it; floor space occupied 6 by 14 feet. The machine is termed a decorticator for ramie, jute and hemp. . . . . .

"*The Fremerey machine.*—In the entry of this machine about 5-horse power is stated. The machine is arranged to work upon green stalks, either stripped or with the leaves and upon dry stalks. It occupies a floor space of about 5 by 18 feet. The machine requires five attendants, three of whom may be boys. . . . . . .

"*The J. J. Green machine.*—Ten-horse power is named as the power required to drive this machine. The entry states that it works upon dried stalks (but it is also expected to work green stalks wish or without leaves). Five attendants are required for full capacity, three of whom may be boys; it occupies a floor space of 8 by 12 feet."

### Trials on Green Stripped Ramie.

"The first trial was with the Kauffman machine, 500 pounds of green stripped stalks having been weighed out for the test. Of this amount 332 pounds of stalks were run through the machine in 42 minutes, when the machine clogged. The result in wet ribbons was 88 pounds, and 168 pounds of stalks remained unworked, owing to the inability of the machine to proceed further.

"The second trial was with the J. J. Green machine, 500 pounds of green stripped ramie stalks having been weighed out fer the test. Of this quantity 225 pounds of stalks had been delignated in 1 hour and 35 minutes, producing 57½ wet ribbons, 275 pounds of green stalks remaining unworked, owing to the inability of the machine to proceed further.

"Mr. Fremery declined to enter this trial after 500 pounds of green stripped ramie stalks had been weighed out, claiming that the stalks were too uneven in size, the construction of his machine requiring medium stalks."

### Conclusions.

In a review of the results of these trials, Mr. Charles Richards Dodge, special agent in charge of fibre investigations, reports as follows :—

"While the figures for a day's work, based on the results of short running, are wholly misleading, it is interesting to note that the output of the Kauffman machine, during the 42 minutes of continuous work before it clogged, represents 4,743 pounds of green stalks in 10 hours of continuous action, or a little over 2 tons, with an output of 1,257 pounds of wet ribbons, equal to about 420 pounds of dry ribbons, which weight would be considerably reduced after the loose hurds and woody matter remaining in the ribbons produced by this machine had been eliminated.

"In like manner, were the J. J. Green machine to run continuously for 10 hours, turning out ribbons at the rate of speed shown when in actual operation (that is, deducting the 67 minutes spent in cleaning and re-adjustment) the output would have shown a capacity of 4,821

pounds of stalks and 1,232 pounds of wet ribbons, equal to about 410 pounds of dry ribbons. But, as shown, both machines were unable to finish the 500 pounds of stalks weighed out to each for the trial.

"The results of the New Orleans trials are satisfactory as far as they have demonstrated the status of the machines entered, and established an American record that gives a starting point for future comparison, as the results of other trials are made known. It is to be regretted, however, that a larger number of machines was not represented. In this report comparisons cannot be made with the best foreign machines, though I shall endeavour to cover the whole ground in a special report, Bulletin No. 5, Fibre Investigations, to be issued at an early date."

The trials with Jute stems were very similar in their results to those noted in the case of Ramie stems. There was no conclusive evidence either way. The best results with Jute stalks as far as they went, were given by the Kauffman machine. This cleaned 100 pound of stalks in 20 minutes, yielding 32 pounds of wet ribbons. The ribbons were described "as well delignated with a very small per-centage of woody waste. The fibre occasionally was somewhat broken."

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## CCLXXXVII.—EARL OF BUTE'S BOTANICAL TABLES.

In the historical account of Kew (*Bulletin*, 1891, p. 291) reference is made to this rare work. Since that was written we have had an opportunity, through the gracious permission of the Queen, of examining the copy in the Royal Library at Windsor which formerly belonged to Queen Charlotte, to whom the work was dedicated. We are greatly indebted to the Queen's Librarian at Windsor. Mr. R. R. Holmes, for his courtesy in personally bringing the volumes to Kew at some trouble to himself.

Seeing that the Earl of Bute resided at Kew, and that the "Botanical Tables" were, probably in part prepared there, some further particulars of the publication may be given in this place.

On the fly-leaf of the first volume of the Windsor copy is the following note in pencil, written by the Rev. John Glover (appointed Royal Librarian by William IV.) :—"Of this work only 16 [sixteen] copies "were printed for presents, at a cost, it is said, of more than 10,000*l*. "This copy belonged to Queen Charlotte, and was purchased at the "sale of Her Majesty's library for, I believe, 100*l*."

Dryander, however, a contemporary of Lord Bute, and librarian to Sir Joseph Banks, states (Cat. Bibl. Banks, iii., p. 133) that only 12 copies were printed, and this statement seems to be substantiated by the following transcript of a note in Sir Joseph Banks's handwriting, wafered into the last volume (IX.) of his set, now in the British Museum.

Number of copies of Lord Bute's Botanical works extant:—

| | | |
|---|---|---|
| Lord Bute - | 2 | One of the copies sold at Mr. Tighe's sale in March 1798 for 120*l.* supposed to be bought by the Earl of Gainsborough.* |
| The Queen - | 1 | |
| Empress of Russia - | 1 | |
| Sir Joseph Banks - | 1 | |
| M. De Buffon - | 1 | At the King of France's Library. |
| Lady By. Mackenzie - | 1 | |
| Lady Ruthven - | 1 | |
| Lady Macartney - | 1 | |
| Duchess of Portland - | 1 | Now Lady Bath's. |
| Mrs. Barrington - | 1 | |
| Mr. Dutens - | 1 | |
| | 12 | |

The full title of the work runs thus:—

Botanical Tables
containing the different Familys of
British Plants
distinguish'd by a few obvious parts
of Fructification rang'd in
a Synoptical method.

[1785.]
[Drawn and engraved by J. Miller-
Johann Sebastian Mueller.]

We have not been able to find a single date connected with the work except that given above in brackets, which is in the first volume of the British Museum copy, and probably in the handwriting of Sir Joseph Banks.

A detailed collation of the work would be rather tedious, as the headings are numerous; but the general nature of the contents may be indicated. There are nine quarto volumes besides a thin volume of letterpress of 51 pages, entitled "Introduction to the General Tables of Plants." This is said to be wanting in the Banksian copy, now in the British Museum; but Dryander includes it in his collation, at the end of volume i., as though bound in with it.

In this volume of the Windsor copy are the two following notes, on loose sheets of paper, in a very shaky though picturesque handwriting, evidently from the nature of the contents that of Lord Bute himself.

"Notwithstanding the Gracious Reception this work met with it is now sent with the utmost diffidence, for although the subject is pleasing, is in truth of too trifling a nature to admit the flattering Idea of its drawing much of Your Majesty's attention."

"These Pages contain a fuller Explanation of The Tabular Method. They are an Introduction to the General History of Vegetables, a very extensive Plan great part of which is done, but there remains still too much for a man at the Extreme of Life to finish."

It may be taken as probable that the date at which these notes were written is about 1785. Lord Bute died from the effects of an accident in 1792.

* This note was pencilled by Dryander, and inked in afterwards apparently by another hand, as we are informed by Mr. B. Daydon Jackson, who kindly made the transcript.

Vol. i.—Pictorial title page followed by dedication to Queen Charlotte in the following words:—

To the Queen.

MADAM,

EXTREMELY flattered with Your Majesty's gracious condescension I place this Work composed solely for the Amusement of the Fair Sex under the Protection of your Royal Name, happy in having this last opportunity of testifying the Respect and Veneration with which I ever have been and ever shall be

Your Majesty's
most devoted and
most obedient
humble servant,
BUTE.

This volume contains further introductory matter and "Observations of the general Character of British Plants," and "Characters of the Genera"), illustrated by 53 plates, with 253 pages of letterpress, in addition to an intercalated "Appendix" and the letterpress explanatory of the figures, which is not paged.

Vol. ii.—"The Different Parts of the Fructification in each Genus of the British Plants represented in Figures." "Figures of the Genera," tables i–viii. 96 plates and pages 1–98.

Vol. iii.—"Figures of the Genera," tables ix–xiv. 96 plates and pages 99–192.

Vol. iv.—"Figures of the Genera," tables xv–xviii. 96 plates and pages 193–290.

Vol. v.—"Figures of the Genera," tables xix–xxii. 97 plates and pages 291–387.

Vol. vi.—"Figures of the Genera," tables xxiii–xxvii. 124 plates and pages 388–510.

Vol. vii.—"The Characters of the Species of British Plants." Pages 1–294.

Vol. viii.—"The Characters of the Species of British Plants." Pages 295–569.

Vol. ix.—"Some Observations on the Terms employed in Botany." "Figures of the different parts of Plants." 90 plates, with letterpress opposite, and 58 pages of glossary.

Altogether the work contains 654 plates, all of them apparently drawn and engraved by John Miller, an excellent German artist—Johann Sebastian Mueller, who thus anglicised his name.

In Dryander's collation of Lord Bute's "Tables," he says, concerning the ninth volume:—"Figuræ hæ, terminos botanicos explicantes, omnes "redeunt in J. Milleri. Illustration of the Termini Botanici of Lin-"næus." We have not seen a copy of the London edition of the work referred to, but in an edition printed at Frankfort the figures are not exactly the same, though some of them are evidently only slight modifications.

In the Kew library we have a volume of proofs before lettering of exactly one third (218) of the plates of Lord Bute's "Tables"; and the same volume contains 10 others which do not appear to have been published. These plates were purchased of Rowsell in 1863 for the sum of one guinea, but without any history. They include some from each of the volumes.

## CCLXXXVIII.—MISCELLANEOUS NOTES.

Mr. John Masters Hillier, lately an attendant in the Museums of Economic Botany, has been appointed, on the results of an examination before the Civil Service Commissioners, an Assistant in the Royal Gardens to date from September 6th last.

Mr. William Watson, lately senior foreman and acting assistant curator of the Royal Gardens, has been granted a certificate by the Civil Service Commissioners as Assistant Curator under clause vii. of the Order in Council of the 4th June 1870.

A Filmy Fern, No. 532, gathered by Messrs. H. H. and G. W. Smith in the island of St. Vincent, West Indies, and distributed under the name of *Trichomanes lucens*, was included under that name in Mr. J. G. Baker's paper in the *Annals of Botany*. Vol. v., p. 163. Upon further comparison Mr. Baker is of opinion that this fern belongs to *T. crinitum*, Sw., which is identical with *T. L'Hermineri*, Fée, and well figured under the latter name in Fée's *Histoire des Fougères et Lycopodiacées des Antilles*, tab. 28, fig. 1. The fern is also found in Jamaica, Guadeloupe and Grenada as well as in St. Vincent.

Under the title of Hardy species of Eucalyptus mention was lately made in the *Kew Bulletin* (1889, p. 61) of seeds of *Eucalyptus Globulus* received from Mr. Abbott of the Botanic Gardens, Tasmania, and collected from trees growing at high altitudes and accustomed to be exposed to severe frosts. It was hoped that plants raised from these seeds would be likely to bear with impunity the rigours of an English winter. The seeds germinated very freely at Kew and when the plants were strong enough they were put out in a sheltered bay in the Arboretum nursery in the middle of summer in order that they might become established before the approach of winter. The result of the experiment in this particular instance was disappointing. The first hard frosts in 1889 so severely injured them that, notwithstanding the protection they afterwards received from a canvas screen, they all succumbed before the winter was over. At Kew these seedlings from blue gum trees accustomed to severe frosts in Tasmania were, if anything, not so hardy as those of the ordinary forms of *Eucalyptus Globulus*. A similar result has to be recorded with plants raised from seeds of *Eucalyptus coccifera* received at the same time from Tasmania "from trees which were coated with icicles a foot long."

Bermuda Lilies.—It is pleasurable to record that the services rendered by Kew to the Colonies is recognised by private persons as well as through official channels. It will be remembered that in 1887 an exhaustive inquiry was made under the auspices of Kew into the onion disease at Bermuda (*Kew Bulletin*, October 1887). The cultivation of onions is one of the principal industries of the colony, and the threatened destruction of the onion crop was regarded by the people as a matter of grave concern. The inquiry made by Mr. Arthur Shipley, F.L.S., established the fact that the disease was caused by a parasitic fungus (*Peronospora schleideniana*) allied to the well known potato blight. The remedial measures suggested by Mr. Shipley were practical, and it is hoped the disease is now well within the control of the cultivators.

Besides onions, Bermuda is also noted for the cultivation of lilies (*Lilium longiflorum*, var. *Harrisii*), and from Mr. W. T. James, one of the largest growers of these beautiful plants, Kew has received in recognition of its services, a yearly present of bulbs for the decoration of its conservatories. These plants have proved of striking interest to visitors, and have been greatly admired.

ACANTHORHIZA ACULEATA, Wendl. The large specimen of this palm in the Palm House, probably the largest in Europe, is now flowering for the first time. It has a stem 26 feet high, 23 inches in circumference near the base, which is clothed to a height of a foot above the ground with the curious spinous roots peculiar to the genus. The head is about 10 feet high and is composed of about 50 leaves which are orbicular palmate, 5 feet in diameter, dark green above, silvery below, split nearly to the base into about 60 segments. The petioles are 3 feet long, unarmed, the margins clothed with white thread-like fibres 9 inches or more long. The infloresecnse is a branched drooping dense panicle of white flowers, which are hermaphrodite. A figure of the plant has been prepared for the *Botanical Magazine*. The species is a native of Central America. It has also been called, *Chamærops stauracantha* and *Thrinax aculeata*. The other species of this genus, viz., *Acanthorhiza arborea* is also in cultivation at Kew.

GLADIOLUS OPPOSITIFLORUS.—Corms of this interesting plant were sent to Kew in July last by Professor MacOwan, F.L.S., Government Botanist at Cape Town, who obtained them from the Transkei, where it is said to be common about the Kei River. The species was described by Herbert in Lindley's *Botanical Register* in 1842, who says it was found in Madagascar by Forbes, a collector for the Royal Horticultural Society, and that "it is also perhaps a native of Natal." In his recently published *Handbook of Irideæ*, Mr. Baker says under this species "Habitat, Transkeian Kaffraria, not certainly indigenous. Said by "Herbert to be a native of Madagascar, but none of the recent collectors "have found it there. Its nearest affinity is with *G. floribundus*." According to Herbert *G. oppositiflorus* is one of the parents of *G. gandavensis*, the other being *G. psittacinus*. *G. oppositiflorus* is now in flower at Kew. It is over 6 feet in height, the leaves are stout and ensiform, and the flowers, which are arranged on a spike 2 feet long are 2½ inches across, the segments wavy and recurved, pure white with lines of amethyst.

CYCADS AT KEW.—The collection of *Cycadaceæ* at Kew is the richest in existence, and many of the specimens are very large and of great age. A considerable number of them have developed cones this year, thereby adding to the attractions of the Palm House, wherein most of the Cycads are grown, as well as affording exceptional opportunities for the study of the order. A collection of the fresh cones and leaves of all the genera was sent from Kew to illustrate the lecture on Cycads given a few weeks ago by W. Carruthers, Esq., F.R.S., before the Royal Horticultural Society. The species which have coned in 1892 are:—*Dioon edule*, *D. spinulosum*, *Ceratozamia mexicana*, *C. miqueliana*, *Zamia muricata*, *Z. Skinneri*, *Macrozamia spiralis*, *M. Fraseri*, *Encephalartos villosus*, *E. Caffer*, *E. Altensteinii*, *Stangeria paradoxa*, *Bowenia spectabilis*, *Cycas circinalis* and *C. revoluta*—male and female cones.

Palms in flower at Kew.—Although palms have always been in favour with cultivators, and this popularity has largely increased in recent years, their nomenclature especially in gardens is considerably confused. This is owing, as Sir Joseph Hooker has stated, "partly to "the impossibility of determining them till they flower, and partly to the "practice that prevails of attaching provisional names to seedlings which "are unrecognisable both as to genus and species when in that state." (*Kew Report*, 1882, p. 10.) The houses at Kew afford exceptional facilities for the growth of most palms to a large size, and as these flower they are carefully examined, and, if of sufficient interest, a figure of them is prepared for publication in the *Botanical Magazine*. Since 1875 no less than 19 species of palms have been figured and described in this publication from specimens flowered at Kew. The following species are now in flower in the various houses:—*Acanthophœnix Cunninghamii*, *Caryota Cummingii*, *C. furfuracea*, *Chamædorea polita*, *C. pulchella*, *C. wobbstiana*, *C. Wendlandii*, *C. scandens*, *Chamærops humilis*, *Didymosperma nanum*, *Howea forsteriana*, *Livistona chinensis*, *Pinanga Kuhlii*, *P. patula*, *P. Smithii*, *Sabal blackburniana*, *Stevensonia grandifolia*, *Synechanthus fibrosus*, *Trachycarpus excelsus*, *Wallichia densiflora*.

From Dr. A. Glaziou, the Director of the Passeio Publico, Rio Janeiro, Kew has received a further consignment of dried plants of the almost inexhaustible Flora of Brazil, consisting of the numbers 18,835 to 20,187. Dr. Glaziou has been working at the flora of Brazil now nearly a quarter of a century, and has presented to Kew, from time to time, a very full set of the plants he has collected during this long period, in return for their approximate names. But he sends his first set to Berlin for the purposes of the monumental "Flora Brasiliensis," now nearly completed; and, as far as possible, the various natural orders are given for determination to those persons who have elaborated them for the work in question. By this mutually advantageous arrangement Mr. J. G. Baker takes the *Compositæ* and the Filices.

New Queensland Plants.—Mr. F. M. Bailey, Colonial Botanist at Brisbane, has sent to Kew another parcel of specimens of his new species. It is a great advantage to possess authenticated specimens of these discoveries, both for the colonists and for botanists in Europe, because important questions may be conclusively answered by their inspection without reference to Australia.

Siam Products.—Members of Her Majesty's Foreign Embassies and Her Majesty's Consular Service have often special opportunities of becoming acquainted with little-known plants and plant products. Many officers belonging to these services have contributed valuable information to Kew and the results have often proved of great importance. For instance, a very interesting report on the manufacture of paper from the bark of *Streblus asper* in Siam by Mr. W. R. D. Beckett, Student Interpreter of Her Majesty's Legation at Bangkok, was printed in the *Kew Bulletin*, 1888, pp. 81–84. Since then Mr. Beckett has made an exploring trip into the Mêkong Valley and brought home numerous specimens which at the request of the Marquis of Salisbury have been worked out at Kew. Amongst Mr. Beckett's specimens were dye-woods, native paper materials, gum and gum resins, woods, safflower, and fibre plants.

Amongst the resins were samples probably derived from the Sâl tree (*Shorea robusta*), possessing properties likely to be valuable in the manufacture of special varnishes. In a report kindly furnished to Kew by Mr. R. Ingham Clark this resin is referred to as follows:— "If there are old forest grounds of the tree producing it, it would be "interesting and more important to find the semi-fossilized kind, for "which no doubt some market could be made." In a further letter, Mr. Clark states:—"We think it a species of Damar; it has a very high "melting point for that kind of gum, viz., 410° Fahr. It runs (that "is, melts and amalgamates with Linseed oil under heat) well, but rather "dark. It contains a considerable amount of moisture, and although "soluble in turpentine it does not amalgamate readily. On account of "the melting point, I should say there might be a practical value in "the article, and it is possible that much better—that is brighter and "paler—specimens might be gathered, as the sample sent is anything "but favourable to the eye. The only method to test it in a sufficient "way to pronounce a definite judgment is to have a bulk sample "of say one-half to one hundredweight, so that one can go beyond "laboratory work."

Mauritius Hurricane.—Consequent upon the terrible hurricane which took place at Mauritius in April, the Department of Forests and Gardens has been closely occupied in clearing the broken trees and disposing of them to the poor to repair and build their huts. In a letter from Mr. William Scott, the Acting Director, he writes:— "We are still going on with the clearing of the Gardens, and have "sent away 400 cords of firewood, and are only half finished with "the work. Many of the surviving trees are green again, or rather "what remains of them, but there are others that appear to have the "life completely thrashed out of them. This is particularly marked "in the Araucarias, Cupressus, Junipers, &c. The whole of the fine "Araucarias are standing like bare poles, with their heads off, and do "not show much appearance of life. We shall not be able to keep "up our exchanges for some time to come. I think about the end of "January we will be in fair order again. All the Filaó trees (*Casu-"arina equisetifolia*) on the *Pas Geometriques* are almost wholly "destroyed, but the virgin forests have not suffered much injury. Our "young plantations are looking well. The Chinese pines (*Pinus "sinensis*) are the best, only about 5 per cent. of them are damaged. "The Eucalypti owe their safety to their youth and suppleness; had "they been older and stronger they would have been broken at a few "feet from the ground. We are at present busy planting Chinese "pines of which we have over 200,000 plants ready."

Bechuanaland Forests.—In a Report on British Bechuanaland recently issued by the Colonial Office [No. 47, Bechuanaland, 1890–1892], the Crown Prosecutor states:—"The wholesale deforestation of "the territory, and of this district in particular, and the exportation of "wood for use as fuel in the diamond mines at Kimberley have caused, "and continue to cause, much alarm. It is an undoubted fact that large "quantities of wood are cut on unoccupied private lands without the con-"sent of the owners. As these owners are not resident in the territory, "convictions under the Forest and Herbage Preservation Act, 1859, are "not easily obtainable. The evil can only be prevented by most stringent "and arbitrary means. A law prohibiting the exportation of wood

" would effect the desired result, but it would, I apprehend, be against the " spirit of the Customs Union Convention." The Administrator, Sir Sidney Shippard, fully realises the situation, but is unable at present to suggest a remedy. " In view of the conditions of the Customs Union," he says, " an export duty on wood could not be imposed in this territory " without the express consent of the Cape Colony and of the Orange Free " State. A preventive might at one time have been found in Mr. A. H. F. " Duncan's suggestion as to establishing a forest department under " the Surveyor-General; but since some of the finest forests in the " western portion of the Crown Colony have been included in the grants " of land made in consideration of railway construction this Government " no longer has the same interest in the question." Something, however, appears to be attempted in the way of protecting the remaining forests, as we learn from the Surveyor-General's Report that " at Kuruman 32,183 morgen have been surveyed, and set apart as a Crown Reserve." It is desirable in every way that this latter policy should be extended as much as possible.

The Right Hon. Sir John Lubbock has published a work in two octavo volumes, with 684 figures (Kegan Paul & Co.), entitled " A CONTRIBUTION TO OUR KNOWLEDGE OF SEEDLINGS." The origin of the research is explained in the following extract from the preface :— " The germination of plants is certainly not the least interesting " portion of their life history, but it has not as yet attracted the " attention it deserves. The forms of cotyledons, and the fact that " they differ so much from the subsequent leaves, had of course been " alluded to, more or less fully, in botanical works, but no explanation " had been offered, and Klebs, in a recent memoir, expressly states that " the problem is still an enigma. Under these circumstances it seemed " to me that the subject was very promising, and it was evident that " Kew would afford unrivalled opportunities for such an investigation." The work describes on a uniform plan a vast number of examples of germination drawn from all parts of the Vegetable Kingdom, and far surpasses in extent any previous investigation of the subject. The living material was almost wholly supplied by the Propagating Department of the Royal Gardens.

COLEUS TUBEROSUS, Benth. — A plant believed to be this species (=Plectranthus tuberosus, *Bl.*) is cultivated in Java for the sake of its edible tubers. The same, or a closely allied tuberous labiate (*Coleus parviflorus*, Benth.), is said to be cultivated also in Ceylon. Recently, tubers of the Java plant were obtained from Dr. Treub, Director of the Botanical Gardens, Buitenzorg, and grown at Kew. The tubers were planted in an open border during the summer, and the crop was reaped in the middle of October. The tubers were fairly numerous, but small. They consisted of fleshy bodies broad at the top and narrowing gradually to a point. They were of a light brown colour, and averaging in size about an inch and a half long and an inch in diameter. It is probable that the tubers attain a larger size in the tropics. A further trial will be made next year, and in a more sandy soil. When a sufficient number of the tubers has been raised at Kew they will be distributed for trial in the lowlands of West Africa and the West Indies, where the ordinary potato, for which the Coleus tubers are said to be a substitute, cannot be successfully cultivated. A tuberous labiate (*Plectranthus madagascariensis*, Benth.), described in Baker's

*Flora of Mauritius and the Seychelles*, p. 258, is occasionally cultivated in Madagascar and Mauritius. In the latter island it is known as *Oumime* or *Houmime*. This plant has a wide distribution, and is found also in Arabia Felix and Natal. In November 1887, Kew received from Mr. Medley Wood, A.L.S., Curator of the Botanic Gardens at Durban, Natal, tubers of two varieties or species of *Plectranthus*, known locally as "Kaffir potato." We have botanical specimens of these plants in the Herbarium (Natal, 646 and 3,633), and they are evidently quite distinct from *Plectranthus madagascariensis*. A specimen just to hand in the Transvaal collections of Mr. Galpin agrees with Mr. Wood's specimens from Natal. The tubers received by MM. Pallieux and Bois from the Transvaal under the name of "Matambala," and referred by them to Coleus tuberosus (*Revue des Sciences Naturelles Appliquées*, 1891, p. 684), may prove to be identical with the "Kaffir potato" (*Plectranthus* sp.) of Mr. Medley Wood, or even with *Plectranthus madagascariensis*. In any case they have been distributed from Paris to the Gaboon and other French colonies, and are said to thrive there extremely well.

Lists of Cultivated Plants.—The progress made in establishing the Botanical Station at Lagos has been frequently noticed (*Kew Bulletin*, 1888, p. 149; 1889, p. 69; 1890, p. 162; and 1891, p. 46). This station was started by Sir Alfred Moloney, in November 1887, and Mr. James McNair, formerly connected with the Botanical Department in Jamaica, was appointed Curator. Since that time considerable success has been attained in cultivating plants received from Kew and elsewhere, and large numbers possessing industrial value have been distributed in the Colony. On the retirement of Mr. McNair in 1891, Mr. Henry Millen from Kew was selected to succeed him. Mr. Millen has received valuable assistance from Dr. Rowland, the Colonial Surgeon. Under their joint authorship the Lagos Government has printed a list of plants cultivated at the station, 443 in number, with notes descriptive of their economic uses. Lists of this kind might be usefully prepared at every Colonial Botanical Establishment. They supply at a glance the particular plants that are available for distribution locally, and they give also information respecting the uses to which the plants or their products could be applied. Such lists might be printed in a pamphlet form and given to visitors, free, or for a small payment to cover the cost of production.

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ROYAL GARDENS, KEW.

# BULLETIN

OF

# MISCELLANEOUS INFORMATION.

APPENDIX I.—1892.

## LIST OF SEEDS OF HARDY HERBACEOUS PLANTS AND OF TREES AND SHRUBS.

The following is a list of such Hardy Herbaceous Annual and Perennial Plants as well as of such Trees and Shrubs as have matured seeds under cultivation in the Royal Gardens, Kew, during the year 1891. These seeds are available for exchange with Colonial, Indian, and Foreign Botanic Gardens, as well as with regular correspondents of Kew. The seeds are only available in moderate quantity, and are not sold to the general public. It is desirable to add that no application, except from remote colonial possessions, can be received for seeds after the end of March.

## HERBACEOUS PLANTS.

Acæna microphylla, Hk. fil., N. Zealand.
myriophylla, Ldl., Chili.
ovalifolia, Ruiz et Pavon, Peru (Ancistrum repens, Vent.)
pinnatifida, R. & P., Chili.
Sanguisorbæ, Vahl, New Zeal.
sericea, Jacq. f., Spain.

Achillea Ageratum, L. Europe.
aegyptiaca, L., Eur., etc.
ligustica, All., Eur.
Millefolium, L., Eur.
— var. rubrum.
Ptarmica, L., Eur.
setacea, W. & K., Eur.

Aconitum heterophyllum, Wall, India.
Lycoctonum, L., Eur., etc.
— var. ochranthum.
— var. orientale, Hort.
Napellus, L., Eur., Temp. Asia.
— var. album.
volubile, Pall., Siberia.

Acroglochin chenopodioides, Schrad., W. Himal.

Actaea spicata, L. N. Amer.

Actinolepis coronaria, Gray, Calif. (Hymenoxys californica, Hook. Bæria coronaria, Gray. Shortia californica, Hort.)

Adenophora liliifolia, Bess., Hungary, etc.
(A. suaveolens, Fisch.)

Adesmia muricata, DC., Chili, Patag.

Adlumia cirrhosa, Raf., Unit. States.

Adonis æstivalis, L., Eur.

Ægopogon pusillus, Beauv., Mexico.

Æthionema Buxbaumii, DC., Thrace.
græcum, B.S., Greece.
grandiflorum, Boiss., Orient.
heterocarpum, Gay, Syria.
saxatile, R.Br., S. Eur.

Agropyrum junceum, Beauv., Eur., etc.
(T. junceum, L.)

Agrostis alba, L., Eur.
— var. stolonifera, (L.)
interrupta, L., S. Eur.
rubra, L., Norway, Sweden.
vulgaris, With., Eur.
— var. foliis variegatis.

Ainsworthia cordata, Boiss., Asia Minor.

Alchemilla argentea, Don., Eur.
(A. conjuncta, Bab.)
vulgaris, L., Eur.

Allium atropurpureum, W. et K., Hungary.
carinatum, L., Eur.
fistulosum, L., Siberia.
giganteum, Regel., Siber.
globosum, Redouté., S. E. Eur.
— var. albidum.
hymenorrhizum, Ledeb., Siberia.
— var. tenuifolium, Regl.
obliquum, L., Siberia.
odorum, L., Siberia.
polyphyllum, Kar. et Kir., Siberia.
Schœnoprasum, L., Eur.
— var. sibiricum, (L.)
senescens, L., Eur., Siber.
siculum, Ucria., Sicily, etc.
triquetrum, L., Eur.

Allium—*cont.*
ursinum, L., Eur.
Victorialis, L., Eur., Siber., etc.

Alonsoa acutifolia, R. et P., Peru.
caulialata, R. et P., Peru.

Alopecurus geniculatus, L., Eur.
nigricans, Hornem., Eur.
pratensis, L., Eur.
— var. fol. variegatis.

Alstrœmeria aurantiaca, Don, Chili.
hæmantha, R. et P., Chili.

Althæa ficifolia, Cav., Dalm., etc.
sulphurea, Boiss. et H., Persia.

Alyssum argenteum, Vitm., Eur.
calycinum, L., Eur.
incanum, L., Eur.
libyca (R. Br.), Spain.
pyrenaicum, Lap., Pyrenees.
saxatile, L., Russia.

Amaranthus chlorostachys, Willd., India.
hypochondriacus, L., Amer., etc.
— var. caudatus, (L.)
— var. speciosus, (Don.)
Margaritae, Hort.
oleraceus, L., N. Ind.
retroflexus, L., Amer., etc.

Amblyolepis (*see* Helenium).

Amsinckia intermedia, F. and M., N. Amer.

Anacyclus radiatus, Loisl., Eur.

Anagallis arvensis, L., Eur., etc.
— var. carnea, (Schrank.)
— var. cœrulea, (Schreb.)
— var. Monellii, (L.)

Androsace nana, Horn, Eur.

Anemone baldensis, L., Eur.
coronaria, L., S. Eur., etc.
decapetala, L., N. Amer.
pennsylvanica, L., N. Amer
polyantha, Don., Himal.
Pulsatilla, L., Eur., etc.
rivularis, Buchan., Himal.
virginiana, L., N. Amer.

Angelica dahurica, Benth. et Hook., Japan.

Anoda Wrightii, Gray, Mexico.

Antennaria dioica, Gærtn., Eur. etc.
— var. tomentosa.

Anthemis ætnensis, Schouw., Mt. Etna.
Bourgœi, B. et R., Spain.
Kitaibellii, Spr., Hungaria.
nobilis, L., Eur.
— var. discoidalis.
peregrina, Willd, S. Eur.
tinctoria, L., Eur.

Anthericum Liliago, L., S. Eur., N. Afr.
— var. Dorseti, Hort.
ramosum, L., Eur.

Anthoxanthum gracile, Biv., Sardinia, Crete, etc.
odoratum, L., Eur.
Puelii, Lecoq. et Lamotte, Eur.

Anthriscus Cerefolium, Hoffm., Eur.
sylvestris, Hoffm., Eur.
vulgaris, Pers., Eur.

Anthyllis tetraphylla, L., S. Eur.

Antirrhinum Asarina, L., Italy.
Orontium, L., Eur.
rupestre, Boiss. et Reut., Spain.

Aquilegia atrata, Koch., Alps, Eur.
Bertolonii, Schott., Ital.
chrysantha, Gray, N. Amer.
— var.
cœrulea × chrysantha.
flavescens, S Wats., Californ.
glandulosa, Fisch., Altai.
— var. parviflora, Regel.
olympica, Boiss., Greece.
sibirica, Lam., Siberia.
— var. alba, Hort.
vulgaris, L., Eur.
— var. monstrosa.

Arabis albida, Stev., Caucas.
— var.
alpina, L., Eur., N. Afr.
cenisia, Reichb., S. Eur.
petræa, Crantz., Eur.
pumila, Jacq., S. Eur.

Arabis—*cont.*
Soyeri, B. et R., Pyrenees.
stricta, Huds., Eur.
Turczaninowii, Led., Siberia.

Archangelica littoralis, Agardh., Carpath.
officinalis, Hoffm., Eur.

Arctium majus, Schk., Eur.
— var. Kotschyi, Hort.

Arenaria balearica, L., Balearic Isles.
hirta, Wormsk., Eur.
fasciculata, Gouan,) Eur. (Alsine Jacquinii, Koch.)
graminifolia, Schrad., S. Eur.
— var. multiflora.
— var. parviflora.
laricifolia, L., Eur.

Argemone hispida, Hook., Calif.
mexicana, L., Mexico.
— var. alba.

Armeria longearistata, B. et R., Spain.
maritima, Willd., Eur.
— var. alba.
— var. laucheana.
vulgaris, Willd., Eur.
Welwitschii, Boiss., Spain.

Arnica amplexicaulis, Nutt., N. Amer.
Chamissionis, Less., N. Amer.
montana, L., Eur.

Arrhenatherum avenaceum, Beauv., Eur.
bulbosum, Presl., S. Eur.

Artemisia annua, L., S. E. Eur.
parviflora, Roxb., India.
rupestris, L., Eur. Siber.

Arum italicum, Mill., Eur.
maculatum, L., Eur.

Asparagus officinalis, L., Eur.

Asperula azurea, Jaub. et Spach., Syria.
tinctoria, L., Eur.

Asphodelus albus, Willd., Eur.
ramosus, L., S. Eur.

Aster Curtisii, Gray., N. Amer.
puniceus, L., N. Amer.
— var. lucidulus, Gray.
(A. vimineus, T. et Gr.)
Radula, Ait., N. Amer.
sibiricus, L. Siber.

Astragalus ægyptiacus, Spr., Egypt.
boeticus, L., Spain, Italy, etc.
chinensis, L., China.
Cicer, L., Eur.
falcatus, Lam., Siberia.
frigidus, Gray, N. Amer.
glycyphyllus, L., Eur.
hypoglottis, L., Eur.
— var. albus.
sulcatus, L., Siber., Taur.

Astrantia Biebersteinii, F. et M., Caucas.
helleborifolia, Salisb. Caucas. (A. maxima, Pall.)
major, L., Eur., etc.
— var. carinthiaca, (Hoppe.)

Athamanta cretensis, L., Eur.

Atriplex hortensis, L., N. Asia.
— var. rubra, Hort.
sibirica, L., Siberia (Obione sibirica, Fisch.)

Atropa Belladonna, L., Eur.

Aubrietia croatica, Schott., Croatia.
deltoidea, DC., S. Eur.
— var. Bougainvillea, Hort.
— var. græca, (Griseb.)
— var. grandiflora.
— var. mooreana, Hort.
— var. purpurea.
— var. Richardi, Hort.
— var. taurica.
erubescens, Griseb., Greece.
gracilis, Sprun., Eur.

Avena brevis, Rth., Eur.
fatua, L., Eur.
— var. intermedia, Lindgr.
Notarisii, Hort.
pratensis, L., Eur. Siber. (A. bromoides, L.)
pubescens, Huds., Eur.
strigosa, Schreb., Eur.

Baeria chrysostoma, F. et M., Calif.
gracilis, Gray, W. Calif.

Bahia lanata, DC., N. Amer. (Eriophyllum cæspitosum, Dougl.)

Baptisia australis, R. Br., N. Amer.

Barbarea intermedia, Bor., Eur.
praecox, Br., Eur.
vulgaris, R. Br., Eur.
— var. variegata.

Beckmannia erucæformis, Host, Eur., etc.

Beta trigyna, W. et K., E. Eur.
vulgaris, L., Eur., Afr., etc.

Bidens humilis, H. B. K., Chili.
leucantha, Willd., N. Amer., etc.

Biscutella ciliata, DC., S. Eur.
didyma, L., S. Eur.
erigerifolia, DC., Spain.

Blitum (*see* Chenopodium).

Blumenbachia insignis, Schrad., Monte Video.

Bocconia cordata, W., China.

Boissiera Danthoniae, A. Br., S. Eur.

Bonaveria Securidaca, Rch., Eur.

Brachycome diversifolia, F. et M., Australia.

Brachypodium distachyum, R. et S., Medit.

Brassica campestris, L., Eur., etc. (B. chinensis, L.)
— var. serotina.
— var. Shantung Cabbage.
Eruca, L., S. Eur.
Erucastrum, Vill., S. Eur.
juncea, Hk. f. et Th., N. Ind.
nigra, Koch, Eur.
oleracea, L., Eur.
— var. capitata.
Pollichii, Shuttl.
quadrivalvis, Hk. f. et Th., India.
rugosa, Roxb., Thibet.
Tournefortii, Gouan, Spain, etc.

Briza gracilis, Hort.
maxima, L., Eur.
media, L., Eur.
minor, L., Eur.
rufibarbis, Hort.

Brodiæa peduncularis, Wats., Calif.

Bromus adœnsis, Hochst.
arvensis, L., Eur.
Biebersteinii, R. et S., Caucas.
breviaristatus, Thurb., N. Amer.
erectus, Huds., Eur., etc.
maximus, Desf., Eur.
— var. Gussonii, (Parl.)
mollis, L., Eur., etc.
patulus, Mert., Eur.
propendens, Jord., Eur.
racemosus, L., Eur.
Schraderi, Kunth., Amer.
Taena, Steud., Chili.
tectorum, L., Eur., Asia.

Browallia viscosa, H.B.K., Peru.

Bryonia dioica, L., Eur.

Bulbine annua, Willd., Cape.

Bunias orientalis, L., Orient.

Buphthalmum speciosum, Schreb., Eur.

Bupleurum Candollei, Wall., Himal.
multinerve, DC., Siberia.
rotundifolium, L., Eur.

Butomus umbellatus, L., Eur.

Calais (*see* Microseris).

Calamintha grandiflora, Lam., S. Eur.

Calandrinia pilosiuscula, DC., Chili.

Calceolaria mexicana, Benth., Mexico.

Calendula hybrida, L., S. Eur.
officinalis, L., S. Eur.

Calliopsis (*see* Coreopsis).

Callistephus chinensis, Nees., China.

Caltha palustris, L., Eur., etc.
— var. minor, Syme.
radicans, Forster, Eur., etc.

Camassia esculenta, Ldl., N. Amer.
Fraseri, Torr., N. Amer.

Camelina sativa, Crantz, Eur., etc.

Campanula alliariæfolia, Willd., Caucas.
carpathica, L. fil., Carpath.
— var. alba.
— var. turbinata, (Schott.)

Campanula—*cont.*
collina, Bbrst., Caucas.
Erinus, L., Eur.
glomerata, L., Eur., etc.
Grossekii, Heuffel., Hungaria.
lactiflora, Bbrst., Caucas.
— var. cœrulea.
latifolia, L., Eur., etc.
— var. macrantha, (Fisch.)
— var. versicolor, (Sib. et Sm.)
latiloba, DC., Olympus.
persicifolia, L., Eur., etc.
— var. alba.
— var. maxima.
rapunculoides, L., Eur.
rhomboidalis, L., Eur.
Scheuchzeri, Vill., Eur.
sibirica, L., Eur., Asia.
Trachelium, L., Eur.
vesula, All., Pedem.

Cannabis sativa, L.

Cardamine græca, L., Greece. (Pteroneuron græcum, DC.)
impatiens, L., Eur.
ludoviciana, Hook., N. Amer.

Carduus acanthoides, L., Eur.
orthocephalus, Wallr. × (C. nutanti × acanthoides, K.).
stenolepis, (K. et K.), Siber.

Carex depauperata, Good., Eur.
flava, L., Eur., etc.
fulva, Good., Eur.
Heleonastes, Ehrh., Eur.
hordeiformis, Whlbrg., Eur. Cauc. (C. hordeistichos, Vill.)
lagopodioides, Schk., N. Amer.
leporina, L., Eur.
multiflora, Mhlbrg., N. Amer.
ornithopoda, Willd., Eur.
ovalis, Good., Eur.
salina, Wahl., Eur.
— var. kattegatensis, (Fr.)
scirpoidea, Michx., N. Amer. (wormskioldiana, Horn.)
sylvatica, Huds., Eur.
tenella, Schk., Eur.
vulpina, L., Eur.

Carpoceras sibiricum, Boiss., Siber.

Carrichtera Vella, DC., Eur.

Carthamus lanatus, L., S. Eur.
tinctorius, L., Eur.

Carum Carvi, L., Eur.
rigidulum, Koch., Italy.

Catananche lutea, L., Italy, etc.

Cathcartia villosa, Hk. f., Himal.

Caucalis daucoides, L., Eur.

Centaurea Cyanus, L., Eur.
cynaroides (Less.), Pyrenees.
dealbata, Willd., Caucas.
eriophora, L., Eur.
helenifolia (G. et G.), S. Eur.
melitensis, L., Eur.
nigrescens, Willd., Eur.
nigra, L., Eur.
rigidifolia, Bess, Caucas.
Scabiosa, L., Eur.
— var. alba.
— var. olivieriana, (DC.)
sonchifolia, L., Medit.
zaphaniana, Hort.

Cephalaria tatarica, Schrad., Siberia.

Cerastium chloræfolium, F. et M., Orient.
frigidum, Bbrst., Caucas.

Ceratocephalus (*see* Ranunculus).

Ceratochloa unioloides, DC., S. Eur. (Bromus unioloides, H.B.K.)

Chænostoma fœtidum, Benth., Cape.

Chamæpeuce (*see* Cnicus).

Charieis heterophylla, Cass, Cape.
— var. rubra.

Cheiranthus Cheiri, L., Eur.

Chelidonium majus, L., Eur.
— var. fl. pl.
— var. laciniatum.

Chelone Lyoni, Pursh, N. Amer.

Chenopodium album, L., Eur.
aromaticum, Hort. Berlin.
Atriplicis, L., China.
Bonus-Henricus, L., Eur.
capitatum, S. Wats., Eur.
fœtidum, Schrad., Eur.
graveolens, Willd., Mexico.
opulifolium, Schrad., Eur.

Chenopodium—*cont.*
Quinoa, L., S. Amer., etc.
urbicum, L., Eur.
virgatum, Benth. et Hook., S. Eur. (Blitum virgatum, L.)

Chorispora tenella, DC., Cauc., etc.

Chrysanthemum cinerariæfolium, Vis., Dalmatia. (Pyrethrum cinerariæfolium, Trev.)
coronarium, L., S. Eur.
— var. album.
— var. fl. pl.
corymbosum, L., Eur. (Pyrethrum Clusii, Fisch.)
latifolium, Willd., Eur. (L. latifolium, DC.)
maximum, DC., Pyrenees.
macrophyllum, W. et K., Eur. (Pyrethrum macrophyllum, Willd.)
multicaule, Desf., N. Afr.
segetum, L., Eur.
Tchihatcheffii (Pyrethrum, Regel), Siber.
viscosum, Desf., Spain.

Cicer arietinum, L., Eur.

Cichorium Intybus, L., Eur.

Cimicifuga racemosa, Nutt., N. Amer.

Circaea lutetiana, L., Eur., etc.

Cirsium (*see* Cnicus).

Cistus platysepalus, Sweet.

Clarkia elegans, Lindl., Calif.
pulchella, Pursh, N. Amer.
— var. alba.

Claytonia perfoliata, Don., N. Amer.
sibirica, L., N. Amer. (C. alsinoides, Sims.)

Clematis integrifolia, L., S. Eur.
ochroleuca, Ait., N. Amer.
orientalis, L., Temp. Asia.
— var. graveolens, Lindl.
recta, L., Eur., etc.
— var. hispanica, Hort.
Viorna, L., N. Amer.
— var. coccinea, James.

Cleome violacea, L., Eur.

Clintonia (*see* Downingia).

Cnicus altissimus, Willd., N. Amer.
diacanthus, Desf., S. Eur.
fimbriatus, Bieb., Taurus.
flavispinus, Ball, Morocco.
lanceolatus, Willd., Eur.
syriacus, Willd., Medit.

Cochlearia glastifolia, L., S. Eur.
officinalis, L., Eur.

Codonopsis ovata, Benth., Himal.

Colchicum speciosum, Stev., Caucas.

Collinsia bartsiæfolia, Benth., Calif.
bicolor, Benth., Calif.
— var. multicolor.
grandiflora, Dougl., N. Amer.
parviflora, Dougl., N. Amer.

Collomia coccinea, Lehm., Chili.
gilioides, Benth., Calif.
grandiflora, Dougl., Calif.
linearis, Nutt., Calif.

Conioselinum Fischeri, Wimm. et Grab., Siber.

Conringia perfoliata, Link, Eur.

Convallaria majalis, L., Eur., Amer.
— var. major.
— var. rosea.

Convolvulus tricolor, L., Medit.
undulatus, Cav., Medit.

Coreopsis auriculata, L., N. Amer.
coronata, Hook., E. Texas.
Douglasii, B. et H., Calif.
(Leptosyne Douglasii, DC.)
maritima, Hook., Calif.
(Leptosyne maritima, Gray.)
lanceolata, L., N. Amer.
— var. villosa, Michx.
tinctoria, Nutt., N. Amer.
— var. bicolor.

Coriandrum sativum, L., Eur., etc.

Corispermum hyssopifolium, L., S. Eur.

Cortusa Matthioli, L., Eur.
— var. grandiflora.

Corydalis glauca, Pursh., United States.
ophiocarpa, Hk. f. et Th., China.

Cosmos bipinnatus, Cav., Mexico.

Cotula coronopifolia, L., Eur.
filicula, Hk. fil., Australia.

Crepis biennis, L., Eur.
Candollei, Spr., Eur.
hyoseridifolia, Tausch., Eur.
pulchra, L., Eur.
rubra, L., S. Eur.
setosa, Hall. f., Eur.
tectorum, L. fil., Eur., Siberia.

Crocus asturicus, Herb., Spain.
Balansae, Gay., As. Minor.
bannaticus, Heuffel, Transylvania.
cancellatus, Herb., Ionian Isles.
Clusii, Gay, Portugal.
dalmaticus, Vis., Dalmatia.
Imperati, Ten., Italy.
lævigatus, Bory. et Chamb., Greece.
medius, Balbis, Riviera.
nudiflorus, Sm., Eur.
Olivieri, Gay, Eur.
Salzmanni, Gay., Morocco.
sativus, L., Cult.
— var. cartwrightianus, Herb.
— var. Elwesii, Maw.
Sieberi, Gay, Greece, etc.
speciosus, Bbrst., Caucas., etc.
suaveolens, Bert., C. Italy.
tommasinianus, Herb., Dalmat.
vernus, All., C. Eur.
— var. albiflorus, Gay.
versicolor, Ker., Eur.
zonatus, Gay, Cilicia.

Crucianella
ægyptiaca, L., Egypt.
græca, Boiss., S. Eur.

Cryptostemma calendulaceum, R.Br., Cape.

Cuminum Cyminum, L., Egypt.

Cuphea lanceolata, Ait., Mexico.
(C. silenoides, Nees.)
viscosissima, Jacq., Amer.

Cuphea—*cont.*
Zimapani, Roezl, Mexico. (C. silenoides, var. Zimapani, Hort.)

Cyananthus lobatus, Wall., Himal.

Cynoglossum officinale, L., Eur.

Cynosurus cristatus, L., Eur.
elegans, Desf., S. Eur.

Cysticapnos africanus, Gærtn., Cape.

Czackia Liliastrum, Andrz., S. Eur.

Dactylis glomerata, L., Eur., etc.

Dahlia coccinea, Cav., Mexico. (D. Cervantesii, Lag.)
variabilis, Desf., Mexico.

Datura fastuosa, L., S. Amer.
— var. rubra.
lævis, L. fil., Africa.
Stramonium, L., Eur.
Tatula, L., Eur., etc.
— var. gigantea.

Daucus Carota, L., Eur., etc.
hispidus, Desf., Eur., N. Afr.

Delphinium Ajacis, Reichb., S. Eur.
cardiopetalum, DC., Eur.
caucasicum, L., Caucas.
cheilanthum, Fisch., Siberia.
— var. bifidum.
— var. elongatum.
crassifolium, Schrad., Cauc.
dictyocarpum, DC., Siberia.
elatum, L., Eur., etc.
— var. intermedium.
formosum, Hort.
grandiflorum, L., China, etc. (D. chinense, Fisch.)
— var.
nudicaule, Torr. et Gr., Calif.
Staphisagria, L., Eur.
triste, Fisch., Siberia.
trolliifolium, Gray., Amer.
vestitum, Wall., Himal.

Deschampsia cæspitosa, Beauv., Eur. (Aira cæspitosa, L.)
— var. vivipara.
flexuosa, Trin., Eur. (Aira flexuosa, L.)

Desmazeria sicula, Dmrt., Eur.

Desmodium canadense, DC., N. Amer.

Dianthus arenarius, L., Eur.
Caryophyllus, L., Eur.
cæsius, Sm., Eur.
— var.
deltoideus, L., Eur.
fimbriatus, Bbrst., Orient.
fragrans, Bbrst., Caucas.
furcatus, Balb., Eur.
liburnicus, Bartl., Eur.
— var. vulturius, Guss.
plumarius, L., Eur.
— var. albus.
— var. serotinus.
prolifer, L., Eur.
pulchellus, Pers., Eur.
Requienii, G. et G., S. Eur.
Seguieri, Vill., Eur.
tener, Balb., Eur.

Dictamnus albus, L., W. Eur., Jap. (D. Fraxinella. Pers.)
— var. purpureus.

Digitalis lutea, L., Eur.
purpurea, L., Eur.
— var. alba, Hort.

Dimorphotheca annua, Less., Cape. (Calendula pluvialis, L.)

Dioscorea pyrenaica, Bub. et Bord., Pyren.

Diphylleia cymosa, Michx., N. Amer.

Diplotaxis erucoides, DC., Mediter.
tenuifolia, DC., Eur.

Dipsacus asper, Wall., Himal.
sylvestris, L., Eur.

Dischisma arenarium, C. A. Mey., Cape.

Dodecatheon Meadia, L., N. Amer.
— var. splendidum.

Dorycnium ibericum, Willd., Caucas., etc.

Draba aizoides, L., Eur.
borealis, DC., Isl. of St. Paul.
carinthiaca, Hopp., Eur.
frigida, Saut., Alps, Eur.

Draba—*cont.*
incana, L., Eur.
— var. stylaris, (Gay.)
lasiocarpa, Reichb., S. Eur.
Traunsteineri, Hopp., Eur.

Dracocephalum Moldavica, L., Siber., etc.
nutans, L., Siberia.
parviflorum, Nutt., N. Amer.
peregrinum, L., Siberia.

Drusa oppositifolia, DC., Teneriffe.

Dryas octopetala, L., Eur., Amer.

Echinops sphærocephalus, L., Eur.

Elsholtzia cristata, Willd., S. Eur.

Elymus sibiricus, L., Siber.

Emex spinosa, Camb., S. Eur.

Encelia subaristata, Gray., N. Amer.

Epilobium alpestre, Jacq., Eur.
alsinefolium, Vill., Eur.
angustifolium, L., Eur.
— var. album.
— var. major.
Fleischeri, Hochst., Eur.
hirsutum, L., Eur.
Lamyi, Schultz, S. Eur.
mexicanum, Moc., Mexico.
nummulariæfolium, A. Cunn., N. Zeal.
— var. pedunculare, Cunn.
parviflorum, Retz., Eur.
roseum, Retz., Eur.
rosmarinifolium, Hænke, Eur.
— var. sericeum.

Eranthis hyemalis, Salisb., Eur.

Eremostachys laciniata, Bnge, W. Asia.

Erigeron aurantiacus, Regel., Turkestan.
glabellus, Nutt., N. Amer.
— var. asperus, Gray.
macranthus, Nutt., N. Amer.
pulchellus, Regel, Turkestan.
strigosus, Muhl., N. Amer.

Erinus alpinus, L., Eur.
— albus.

Eritrichium strictum, Dcne., Himal.

Erodium cicutarium, L'Herit., Eur.
macradenium, L'Herit., Alps.
moschatum, L'Her., Eur.
Salzmanni, Del., Eur.

Ervum Lens, L., Eur., etc.
— var. microcarpum,

Eryngium giganteum, Bbrst., Caucas.
macrocalyx, Schr., Songaria.

Erysimum marshallianum, Andrz., Siber.
perowskianum, Fisch. et Mey., Caucas.
Wahlenbergii, Simonk, Transs.

Erythræa diffusa, Woods, Azores.

Eschscholtzia californica, Cham., Calif.
— var. alba.
— cæspitosa, Brewer.
(E. tenuifolia, Bth.)

Eucharidium concinnum, F. et M., Calif.
— var. grandiflorum.

Eupatorium ageratoides, L., N. Amer. (E. Fraseri, Hort.)

Euphorbia exigua, L., Eur.
heterophylla, L., Ind., etc.
Lagascæ, Spr., Spain.
medicaginea, Boiss., Spain.
Myrsinites, L., Eur.
Preslii, Guss., Eur.
schimperiana, Hochst., Abyss.

Fedia Cornucopiae, G., Eur.

Ferula communis, L., Eur.
gigantea, Horn., S. Eur.
glauca, L., S. Eur.
Linkii, Web., Ins. Canaries.

Festuca arundinacea, Schreb., Eur.
(F. decolorans, Mert.)
delicatula, Lag., Eur.
Drymeja, Mert., Eur.
duriuscula, L., Eur., Amer.
— sub-var. crassifolia,
elatior, L., Eur., etc.
— var. pratensis, (Huds.)
gigantea, Vill., Eur.
Halleri, All., S. Eur.
heterophylla, Lam., Eur.
Myurus, L., Eur. (Vulpia Myurus, Gmel.)

Festuca—*cont.*
Poa, Kunth., S. Eur.
rigida, Kunth, Eur. (Sclerochloa rigida, Panzer.)
rubra, L., Eur.
sciuroides, Roth, Eur. (Vulpia bromoides, Link, F. bromoides, L.)
scoparia, Kern., Pyren.

Flaveria repanda, Lag., N. Amer.

Francoa appendiculata, Cav., Chili.
ramosa, Cav., Chili. (F. picturata, Van Houtte.)
sonchifolia, Cav., Chili.

Fritillaria delphinensis, Gren., Eur.
— var. Moggridgei, (Boiss. et Reut.).
Meleagris, L., Eur.
— var. alba.
ruthenica, Wikstr., Orient.

Fumaria amarysia, B. et H., Eur.
densiflora, DC., Eur.
— var. (micrantha, Lag.)
macrosepala, Boiss., Spain.
major, Bad., Eur. (F. media, DC.)

Funkia lancifolia, Spr., Japan.
— var. albo-marginata, Hort.
ovata, Spr., Japan.
sieboldiana, Lodd., Japan.
subcordata, Spr., Japan. (F. grandiflora.)

Gaillardia pulchella, Foug., N. Amer.
— var. grandiflora.

Galatella (*see* Aster).

Galega orientalis, Lam., Orient.
— var.

Galeopsis pyrenaica, Bartl., Pyren.

Galinsoga brachystephana, Regel., S. Amer.
parviflora, Cav., Amer.

Galium parisiense, L., Eur.
recurvum, Reg., Greece.
saccharatum, All., Eur.
tenuissimum, Bbrst., Cauc.
tricorne, With., Eur.
verum, L., Eur.

Gaura parviflora, Dougl., N. Amer.

Gentiana acaulis, L., Eur.
asclepiadea, L., S. Eur.
— var. alba.
cruciata, L., Eur. Siber.
lutea, L., Eur.
Pneumonanthe L., Eur.
septemfida, Pall., Caucas. (G. gelida, Hort.)
— var. cordifolia, Hk. f.
tibetica, King, Himal. (G. macrophylla, Hort.)
verna, L., Eur.

Geranium albanum, M. B., Tauria.
albiflorum, Ledeb., Siber.
armenum, Boiss., Orient.
columbinum, L., Eur.
gymnocaulon, DC., Caucas.
lucidum, L., Eur.
molle, L., Eur.
rotundifolium, L., Eur.
sylvaticum, L., Eur.

Gerbera Anandria, Schultz., China, Japan.

Geum chiloense, Balb., Chili.
— var. grandiflorum, Ldl.
— var. miniatum, Hort.
heterocarpum, Boiss., Spain.
hispidum, Fr., Spain.
macrophyllum, Willd., Siber.
montanum, L., Alps, Eur.
pyrenaicum, Ram., Pyrenees.
rivale, L., Eur.
triflorum, Pursh., N. Amer. (Sieversia triflora, Spr.)
urbanum, L., Eur., etc.

Gilia achilleæfolia, Bth., Calif.
androsacea, Steud., Calif. (Leptosiphon androsaceus, Bth.)
capitata, Dougl., Calif.
inconspicua, Dougl., Calif.
laciniata, R. et P., Chili, Peru.
micrantha, Steud., Calif. (L. luteus, Benth.)
squarrosa, Hook. et Arn., Amer.
tricolor, Benth., Calif.
— var. alba.

Gladiolus segetum, Gawl., S. Eur.

Glaucium corniculatum, Curt., S. Eur.
— var. rubrum, Hort.
flavum, Crantz., Eur. (G. luteum, Scop.).

Globularia trichosantha, Fisch. et Mey., Orient.

Glyceria elongata, Trin., N. Amer.
maritima, Wahl., Eur.
remota, Fr. Eur.
(G. norvegica, Smf.)

Gnaphalium indicum, L., India.

Godetia (*see* Œnothera).

Gunnera scabra, R. et P., Peru, etc.

Gypsophila paniculata, L., Siberia.
Rokejeka, Del., Egypt.

Hablitzia tamnoides, Bbrst., Caucas.

Hastingia alba, S. Wats., N. Amer.

Hebenstreitia dentata, Thunb., Cape.
tenuifolia, Schrad., Cape.

Hedypnois (*see* Rhagadiolus).

Hedysarum boreale, Nutt., N. Amer.
flavescens, Regel. et Schmidt, Turkestan.
neglectum, Ledeb., Attai.
obscurum, L., Eur.

Helenium setigerum, B. et H., California.

Helianthemum ægyptiacum, Mill., Egypt, etc.
polifolium, Mill., Eur.
vulgare, Gærtn., Eur.
— var.

Helianthus annuus, L., N. Amer.

Helichrysum bracteatum, Willd., Austral.
— var. album.
— var. luteum.

Heliophila amplexicaulis, L. fil., Cape.
araboides, Sims, Cape.
(H. pilosa, Lam.)
crithmifolia, Willd., Cape.

Helipterum Manglesii, Bth., Austral.
(Rhodanthe Manglesii, Ldl.)
Milleri, Hort., Australia.
roseum, Benth., Australia.
(Acroclinium roseum, Hk.)

Helleborus orientalis, Lam., Greece.
— var. roseus,

Helminthia echioides, G., Eur.

Helonias bullata, L., N. Amer.
— var. latifolia.

Hemerocallis flava, L., S. Eur.
fulva, L., S. Eur., etc.
— var. Kwanso, Regel.

Heracleum Panaces, L., S. Eur.
sprengelianum, W.A., Ind. Or.
villosum, Fisch., Russia.

Herniaria hirsuta, L., Eur.

Hesperis matronalis, L., Eur., Siber.

Heuchera americana, L., N. Amer.
cylindrica, Dougl., N. Amer.
Drummondi, Hort.
hispida, Pursh, N. Amer.
(H. Richardsonii, R. Br.)
pilosissima, F. et M., N. Amer.
pubescens, Pursh, N. Amer.
sanguinea, Eng., N. Amer.

Hibiscus Trionum, L., Cosmopol.
(H. africanum, Hort.)

Hieracium aurantiacum, L., Eur.
integrifolium, Lge., Eur.
longifolium, Schleich., Eur.
maculatum, Sm., Eur.
pallidum, Biv., Eur.
pulmonarioides, Vill., Eur.
pratense, Tausch., Eur.
prenanthoides, Vill., Eur.
— var. riphæum, Uechtr.
saxatile, Jacq., S. Eur.
silesiacum, Krause, Eur.
— var. Engleri, Uechtr.
stoloniflorum, W. et K., S. Eur.
villosum, L., Eur.
virgatum, Pursh., N. Amer.

Holcus lanatus, L., Eur.
mollis, L., Eur.
— var. variegatus.

Hordeum murinum, L., Eur.
pratense, Huds., Eur.
vulgare, L., Sicily.

Horminum pyrenaicum, L., Pyren.

Hoteia (*see* Astilbe).

Hyacinthus amethystinus, L., Spain.
romanus, L., S. Eur., etc.
(Bellevalia romana, Reichb.)

Hydrophyllum canadense, L., N. Amer.

Hymenophysa pubescens, Meyer., Siber.

Hyoscyamus niger, L., Eur.
— var. albus, Hort.
orientalis, Bbrst., Cauc.

Hypecoum procumbens, L., S. Eur.

Hypericum Richeri, Vill., Eur.
— var. Burseri, Sp., Transs.

Hypochæris arachnoidea, Poir., N. Afr.

Iberis amara, L., Eur.
ciliata, All., Alp. Marit.
garrexiana, All., Pyrenees.
lagascana, DC., Spain.
pectinata, Boiss., Spain.
umbellata, L., S. Eur.
— var. carnea.

Impatiens parviflora, DC., Siberia, etc.
Roylei, Walp., Himal.
tricornis, Wall., Himal.

Inula ensifolia, L., Eur.
grandiflora, Willd., Caucas., etc.
squarrosa, L., Eur.

Iris Fieberi, Seidl., Eur.
hybrida, Retz., Hort.
(amœna, DC.)
Pseudacorus, L., Eur., etc.
setosa, Pallas, Siberia.
— var. atropurpurea.
sibirica, L., Eur., Siberia.
versicolor, L., N. Amer.
Xiphium, Jacq., N. Spain.
(I. pyrenaica, Bub.)

Isatis tinctoria, L., Eur., etc.

Iva xanthiifolia, Nutt., N. Amer.
(Cyclachæna xanthiifolia, Fres.)

Juncus compressus, Jacq., Eur.
lamprocarpus, Ehrh., Eur.
platycaulis, H. B.K.S., Amer.
supinus, Mœnch., Eur.
tenuis, Willd., Eur.

Knautia (*see* Scabiosa).

Kniphofia corallina, Garden hybrid.
Macowani, Baker, Cape.

Kochia scoparia, Schrad., Eur.

Kœleria Berythea, B. et B., Syria.
cristata, Pers., Eur.
phleoides, P., Eur.

Kœlpinia (*see* Rhagadiolus).

Lactuca flavida, Jord., S. Eur.
lactucaria, Jacq., Eur.
Plumieri, Gren. et Godr., S. Eur.
Scariola, L., Eur.
undulata, Ledeb., Siberia.
virosa, L., Eur.

Lallemantia peltata, Fisch. et Mey., Caucas.

Lasthenia glaberrima, DC., Amer.

Lathyrus angulatus, L., S. Eur.
Aphaca, L., Eur.
aureus, Benth. et Hook., Taur.
(Orobus aureus, Stev.)
Clymenum, L., S. Eur.
(O. Jordani, Tenore.)
filiformis, Lam., S. Eur.
luteus, B. et Hk. f., Eur., etc.
(Orobus luteus, L.)
macrorrhizus, Wimm., Eur.
niger, Wimm., Eur.
(O. niger, L.)
Ochrus, L., Eur.
pisiformis, L., Siberia, etc.
rotundifolius, Willd., Caucas.
sativus, L., Eur.
— var. albus.
sphæricus, Retz., Eur.
sylvestris, L., Eur.
— var. Wagneri,
tenuifolius, Desf., Eur., etc.
tingitanus, L., N. Afr.
— var. atropurpureus.
tuberosus, L., Eur.
variegatus, B. et H., Pyrenees.
(O. variegatus, Lap.)

Lathyrus—*cont.*
venosus, Muhl., N. Amer.
— var.

Lavatera thuringiaca, L., Eur., etc.
trimestris, L., Medit.
— var. alba.

Layia Calliglossa, Gray., Calif.
glandulosa, Hk. et Arn., Calif., etc.
heterotricha, Gray, Calif. (Callichroa platyglossa, Fisch. et Mey.)

Leontodon (Hemilepis) Ehrenbergii,

Leontodon (Kalbfussia) Mülleri, (Sz.), Eur.

Lepidium calycotrichum, Kze., Eur.
Draba, L., Eur.
incisum, Roth, Eur.
Menziesii, DC., N. Amer.
sativum, L., Eur.

Leptochloa fascicularis, Gr., N. Amer.

Leptosiphon (*see* Gilia).

Leptosyne (*see* Coreopsis).

Lepturus cylindricus, Trin., Eur.

Leucoium æstivum, L., Eur., etc.

Libanotis montana, Crantz, Eur.
sibirica, Koch., Eur., etc.

Ligularia (*see* Senecio).

Ligusticum scoticum, L., Eur. (Haloscias scoticus.)
Seguieri, Koch., S. Eur.
Thomsoni, Clarke., Himal.

Limnanthes Douglasii, R. Br., Amer.
— var. grandiflora.

Linaria anticaria, Boiss., Spain.
bipartita, Willd., N. Afr.
Broussonetii, Poir., Orient.
dalmatica, Mill., Dalm.
genistæfolia, Mill., Eur.
— var. linifolia, Grab.
minor, Desf., Eur., N. Afr.
multicaulis, Desf., Ital.
— var. multipunctata, Steud.
Perezii, Gay., Eur.
prætermissa, Delas., France.

Linaria—*cont.*
purpurea, L., Eur., etc.
reticulata, Desf., N. Afr.
— var. purpurea.
saxatilis, Affgg., Eur.
spartea, Hoffm., S. Eur.
triphylla, Willd., S. Eur.
tristis, Mill., S. Eur.
vulgaris, Mill., Eur.

Linum africanum, L., Afr.
alpinum, L., Eur. (L. Leonii, Schultz.)
angustifolium, L., Eur.
maritimum, L., Eur.
perenne, L., Eur., etc.
— Lewisii, (Mhlbrg.)
usitatissimum, L., Eur.

Lithospermum latifolium, Michx., N. Amer.

Loasa prostrata, Gill., Chili.
volcanica, Andr., New Gren. (L. Wallisii, Hort.)

Lobelia decumbens, Rich.,
Erinus, L. Cape.

Lolium perenne, L., Eur.
— var. italicum, (Braun.)

Lonas inodora, Gærtn., Sicily. (Athanasia annua, L.)

Lopezia coronata, Andr., Mexico. (L. minuta, Hort.)

Lotus corniculatus, L., Eur.
major, Scop., Eur.
ornithopodioides, L., Eur.
tenuis, W. et K., Eur., etc.

Lunaria annua, L., Eur.
rediviva, L., S. Eur.

Lupinus angustifolius, L., S. Eur.
— var. macrocarpus, Hort.
arboreus, Sims, N. Amer.
— var.
Cosentini, Guss., Greece, etc.
elegans, H. B. K., Mexico.
hilariensis, Benth., Brazil.
luteus, L., France, etc.
micranthus, Dougl., N. Amer.
nootkaensis, Don, N. Amer.
polyphyllus, Ldl., N. Amer.
— var.

Lupinus—*cont.*
— var. densus.
pubescens, Benth., N. Amer.
recurvatus, Meyen., Chili.
tricolor, Hort.
varius, L., Eur.

Luzula angustifolia, Poir., Carolina.
campestris, DC., Eur.
spicata, DC., Eur.

Lychnis chalcedonica, L., E. Eur., etc.
— var. alba.
diurna, Sibth., Eur.
diurna × alba, Hort.
Flos-jovis, Desv., S. Eur.
Githago, Lam., Eur. (Agrostemma Githago, L.)
Haageana, Lemaire, Japan.
— var. hybrida.
— var. nana.
Lagascæ, Nym., Eur.
læta, Ait., S. Eur., etc.
oculata, Ldl., Levant.
— var. elegans.
Viscaria, L., Eur.
— var. alba.

Lysimachia acroadenia, Max., Japan.
ciliata, L., N. Amer.
davurica, Willd., Davuria.
punctata, L., Eur.
vulgaris, L., Eur.

Madia elegans, Don., N. Amer.
sativa, Molina., Oregon, Calif.

Malcolmia africana, R.Br., S. Eur., N. Afr.
chia, DC., Greece.
flexuosa, Sibth., Greece.
littorea, R.Br., S. Eur.
maritima, R.Br., S. Eur., etc.
mongolica, Max., Mongol.

Malope trifida, Cav., N. Afr.
— var. alba.

Malva crispa, L.
oxyloba, Boiss., Oriens.
parviflora, L., Eur.
sylvestris, L., Eur., etc.
— var. alba.
verticillata, L., Eur.
(M. glomerata, Hort.)

Malvastrum limense (L.), Chili.

Mandragora vernalis, Bert., Orient.

Marrubium astracanicum, Jacq., Caucas.
vulgare, L. Eur.

Matricaria caucasica, Benth., Caucas. (Pyrethrum caucasicum, Willd.)
inodora, L., Eur.
— var. discoidea (DC.).

Meconopsis cambrica, Vig., Eur.
nepalensis, DC., Nepal.
wallichiana, Hook, Himal.

Medicago apiculata, W., Eur. (berteroana, Mor.)
aschersoniana, Urban, N. Afr.
Echinus, DC., S. Eur.
lappacea, Desr., S. Eur.
lupulina, L., Eur.
murex, Willd., Eur.
muricata, All, Eur.
orbicularis, Willd., S. Eur.
rigidula, Lam., S. Eur. (M. Gerardi, Kit.)
Terebellum, Willd., S. Eur.
tuberculata, W., Eur.

Melica ciliata, L., Eur., etc.
— var. penicillaris, (Boiss.)

Melilotus alba, Desr., Eur.
officinalis, Desr., Eur.
parviflora, Lam., Eur. (M. indica, All.)

Mentzelia Lindleyi, T. et G., Calif.

Mesembryanthemum pinnatifidum, L. fil., Cape.
pomeridianum, L., Cape.

Mimulus cardinalis, Dougl., N. Amer.
cupreus, Veitch., Chili.
Lewisii, Pursh, N. Amer.
luteus, L., N. Amer.
moschatus, Dougl., N. Amer.

Molinia cærulea, Mœnch, Eur.
— var. variegata.

Molopospermum cicutarium, DC., C. et S., Eur.

Monolepis chenopodioides, Moq., N. Amer.

Morina longifolia, Wall., Nepal.

Mulgedium (*see* Lactuca).

Muscari argaei, Hort.
armeniacum, Baker, Medit.
atlanticum, Boiss., Spain, Algeria.
Heldreichii, Boiss., Greece.
neglectum, Guss., S. Eur.
racemosum, Mill., Eur.
szovitsianum, Regel, Siber.

Myosotis arvensis, Hoffm., Eur.
palustris, With., Eur.
sylvatica, Hoffm., Eur.
— var. compacta-aurea, Hort.

Myosurus minimus, L., Eur., etc.,

Myrrhis odorata, Scop., Eur.

Nardurus tenellus, Rchb., Spain.

Nardus stricta, L., Eur.

Nasturtium pyrenaicum, R.Br., S. Eur.

Nemophila aurita, Lindl., Calif.
insignis, Dougl., Calif.
— var. alba, Hort.
— var. grandiflora, Hort.
maculata, Bth., Calif.
Menziesii, Hook. et Arn., Calif.
parviflora, Dougl., N. Amer.

Nicandra physaloides, Gaertn., Peru.

Nicotiana affinis, T. Moore.
alata, Link., Brazil.
auriculata, Agardt.
Langsdorffii, Weinm., Brazil.
paniculata, L., S. Amer.
rustica, L., S. Eur., etc.
Tabacum, L., S. Amer.

Nigella damascena, L., S. Eur.
— var.
sativa, L., S. Eur.

Nothoscordum fragrans, Kunth., Amer.

Œnanthe crocata, L., Eur.
globulosa, L., S. Eur.
gymnorrhiza, Brign., C. et S., Eur.
karsthia, Hacq., Carniol.
peucedanifolia, Poll., Eur.

Œnothera amœna, Lehm., Calif.
(Godetia amœna, Lilja.)
— var. rubicunda, Hort.
densiflora, Lindl., Calif.
dentata, Cav., N. Amer.
fruticosa, L., N. Amer.
— var. Youngii, Hort.
glauca, Michx., N. Amer.
odorata, Jacq., Patagonia.
pumila, L., N. Amer.
rosea, Ait., N. Amer.
Sarrazinii, (Haage et Schmidt).
tenella, Cav., Chili, Amer.
(G. tenella, Wats.)

Ononis arvensis, Mur., Eur.
Natrix, L., S. Eur.
spinosa, L., Eur., etc.
repens, L., Eur.
(procurrens, Wallr.)

Onopordon Acanthium, L., Eur.

Orchis foliosa, Sol., Madeira.
incarnata, L., Eur.
latifolia, L., Eur.
maculata, L., Eur.
— var. superba.

Origanum vulgare, L., Eur.
— var. album.

Ormenis (*see* Anthemis).

Ornithogalum arcuatum, Steven., Cauc.
latifolium, L., Egypt, etc.
umbellatum, L., Eur., etc.
— var. Leichtlinii.

Orobanche minor, Sm., Eur.

Orobus (*see* Lathyrus).

Oxyria elatior, R. Br., Nepal.

Oxytropis ochroleuca, Bunge, Siber.

Pachypodium erysimoides, Web., N. Amer.

Pæonia arietina, Anders., Orient.
— var. Andersoni.
decora, Anders., Orient.
— var. Pallasii, Hort.
peregrina, Mill., Orient.

Palava flexuosa, Mast., Peru.

Pancratium illyricum, L., S. Eur.

Panicum colonum, L., Eur., Ind., etc.
Crus-galli, L., S. Eur.
miliaceum, L., Ind., etc.

Papaver apulum, Ten., Eur.
Argemone, L., Eur.
californicum, Gray., Calif.
dubium, L., Eur.
— var. Lecoqii (Lamotte), Eur.
lævigatum, Bbrst., Tauria.
nudicaule, L., Alps.
— var. album.
orientale, L., Orient.
— var. bracteatum, (Lindl.)
— var. majus.
pavoninum, C. A. Mey., Afghan.
pilosum, Sibth., Greece.
— var.
Rhœas, L., Eur.
— var. Hookeri, (Baker).
— var. "Shirley."
rupifragum, Boiss., Spain.
— var. atlanticum, Ball, G. Atlas.
somniferum, L., China, etc.
— var. album.
— var. "Danebrog."
— var. fl. pl.
— var. setigerum, (DC.)

Parietaria lusitanica, L., Eur.
officinalis, L., Eur.

Parnassia nubicola, Hook. fil., Himalaya.
palustris, L., Eur.

Pastinaca (*see* Peucedanum).

Pentstemon barbatus, Nutt., N. Amer.
— var. Torreyi, Gray.
confertus, Dougl., N. Amer.
diffusus, Dougl., N. Amer.
glaber, Pursh., N. Amer.
Hartwegii, Benth., Mexico.
ovatus, Dougl., N. Amer.

Perezia multiflora, Less., Peru, etc.

Petunia nyctaginiflora, Juss., La Plata.

Peucedanum Ostruthium, K., Eur.
sativum, Benth., Eur. (Pastinaca sativa, L.)

Phaca oroboides, DC., Eur.

Phacelia divaricata, Gray., Calif.
tanacetifolia, Bth., Calif.
viscida, Torr., Calif.
Whitlavia, Gray, Calif. (Whitlavia grandiflora, Hort.)
— var. alba, Hort.

Phalaris cærulescens, Desf., S. Eur., etc.
paradoxa, L., S. Eur.
tuberosa, L., Eur.

Phaseolus compressus, DC.
— var. cervinus.
ellipticus, Schur.
— var. aureus.
— var. niger.
— var. mesomelus.
multiflorus, Lam.
— var.
oblongus, Savi.
— var. alba-rubra.
— var. Londonensis.
— var. carneo-flavescens.
ricciardianus, Ten.
tuberosus, Lour., Cochinchina.
vulgaris, L., India.
— var. alba.
willmotianus, Mart.
wightianus, Grah., India.

Phleum asperum, Jacq., Eur.
Bœhmeri, Wib., Eur.
pratense, L., Eur.
— var. parnassicum, Boiss.
— var. nodosum, (L.)

Phlomis agraria, Ledeb., Siberia.
russeliana, Lagas., Orient.
tuberosa, L., Caucas., Siber.
umbrosa, Turcz., Siberia.

Physalis Alkekengii, L., Eur.

Phyteuma Halleri, All., S. Eur.
limonifolium, Sibth. et Sm., Eur.
nigrum, Schmidt, Germ.
orbiculare, L., Eur.

Phytolacca acinosa, Roxb., India.

Picridium tingitanum, Dsf., Eur.

Pisum Jombardi, Schrank.
sativum, L., Eur.
— var. ahebaicum.
— var. quadratum, Mill.

Plantago arenaria, L., Eur.
Coronopus, L., Eur.
— var. Cupani, Guss.
cumingiana, Fisch. et Mey., Chili.
Ispaghula, Roxb., India.
lanceolata, L., Eur.
maritima, S., Eur.

Platycodon grandiflorum, A.DC., Siber.
— var. Mariesii, Hort.

Platystemon californicus, Benth., Calif.

Pleurospermum pulchrum, Aitch. et Hemsl., Afghan.

Poa compressa, L., Eur.
glauca, Sm., Eur.
palustris, L., Eur.
pratensis, L., Eur.
sudetica, Haenke, Eur.
trivialis, L., Eur.
violacea, Bell., Eur.

Podophyllum Emodi, Wall., Himal.

Polemonium cæruleum, L., Eur., Amer., etc.
— var. album, Hort.
— var. bipinnatum, Hort.
— var. grandiflorum, Hort.
flavum, Greene, Amer.
himalayanum, Baker., Himal.
pauciflorum, Wats., Mexico.
reptans, L., N. Amer.

Polygonatum giganteum, Dietr., N. Amer. (P. latifolium, Desf.)
verticillatum, All., Eur.

Polygonum aviculare, L., Eur. (P. erectum, Rth.)
Bistorta, L., Eur.
capitatum, Don., Himalayas.
divaricatum, L., Siber.
molle, Don, Himal.
viviparum, L., Eur.
Weyrichii, F. Schm., Sachal. Isl.

Potentilla alchemilloides, Lap., Pyrenees.
argentea × verna.
argyrophylla, Wall., Himal.
— var.
crocea, Hall f., Eur.
Detommasii, Ten., Eur.
digitata × flabellata.
Fenzlii, Lehm., Cappadocia.
glandulosa, Ldl., Calif.
kotschyana, Fenzl., Kurdistan.
kurdica, Boiss., Orient.
leschenaultiana, Ser., Ind., Or.
malacophylla, Bunge., Orient.
nepalensis, Hook., Nepal. (P. formosa, Don.)
nevadensis, Boiss., Spain.
norvegica, L., Eur.
pedata, Willd., France.
pennsylvanica, L., N. Amer.
— var. arachnoidea, Lehm. (P. arachnoidea, Dougl.)
pseudo-chrysantha.
pyrenaica, Ram., Pyren.
recta, L., Eur., Caucas.
— var. hookeriana, (Lehm.)
— var. laciniata.
— var. macrantha, (Leab.)
— var. palmata.
rupestris, L., Eur.
schrenkiana, Regel.
Sibbaldia, Haller fil., Himal. (Sibbaldia procumbens, L.)
Visianii, Panc., Eur.
wrangeliana, Fisch., Siberia.

Poterium Sanguisorba, L., Eur.

Primula clusiana, Tsch., Eur.
elatior, Jacq., Eur.
floribunda, Wall., Himal.
japonica, Gray, Japan.
mollis, Nutt., Bootan.
obconica, Hance., China.
sikkimensis, Hook., Himal.
verticillata, Forsk., Arabia.

Prunella grandiflora, L., Eur., Cauc.
var. laciniata, Hort.
— var. rubra, Hort.
vulgaris, L., Eur.

Pteroneuron = Cardamine.

Pyrethrum (*see* Chrysanthemum).

Pyrrhopappus carolinianus, DC., Florida, Texas.

Ramondia pyrenaica, Rich., Pyrenees.

Ranunculus abortivus, L., N. Amer.
Broteri, Freyn., Spain.
acris, L., Eur.
arvensis, L., Eur.
brutius, Tenore, Italy.
cassius, Boiss., Taurus.
chærophyllus, L., Eur., etc.
chius, DC., Greece, etc.
Cymbalaria, Pursh, N. Amer.
falcatus, L., Eur.
lateriflorus, DC., Eur.
maritimus, Ph., Chili.
muricatus, L., Eur.
ophioglossifolius, Vill., Eur.
parviflorus, L., Eur.
repens, L., Eur.
reuterianus, Boiss., S. Eur.
trachycarpus, F. et M., Orient.

Raphanus sativus, L., Eur.

Rapistrum linnæanum, All., Eur.

Reseda abyssinica, Fres., Abyss.
alba, L., S. Eur.

Rhagadiolus stellatus, Gærtn., S. Eur.

Rheum collinianum, Baillon.
Emodi, Wall., Himal.
leucorrhizum, Pall , Siber.
macropterum, Mart.
officinale, Baill., Thibet.
palmatum, L., Ind., etc.
— var. tanghuticum.
Rhaponticum, L., Siber.
rugosum, Desf., Ind. Or.
spiciforme, Royle, India.
Tranzenbachii, Hort. Berlin.
undulatum, L., Siberia, etc.
webbianum, Royle., India.

Rhodanthe (*see* Helipterum).

Rudbeckia bicolor, Nutt., N. Amer.
fulgida, Ait., N. Amer.

Rumex abyssinicus, Jacq., Abyss.
alpinus, L., Eur.
Brownii, Campd., Austral.
maximus, Schreb., Eur.
nepalensis, Spr., Himal.

Rumex—*cont.*
obtusifolius, L., Eur.
— var. sylvestris, (Wallr.)
Patientia, L., S. Eur.
salicifolius, Weinm., N. Amer.
vesicarius, L., N. Afr.

Ruta graveolens, L., Eur.
— var. variegata.

Sagina glabra, Willd., S. Eur.
— var. pilifera.
Linnæi, Presl., Eur.

Salvia æthiopis, L., Eur.
argentea, L., Medit.
coccinea, L., Mexico.
glutinosa, L., Eur.
Horminum, L., S. Eur.
— var. bracteis violaceis.
hians, Royle., Ind.
interrupta, Schousb., Marocco.
pratensis, L., Eur.
— var. alba.
— var. Baumgarteni, Grsb., Transs.
— var. rosea.
Sclarea, L., S. Eur.
tiliæfolia, Vahl, Mexico.
Verbenaca, L., Eur.

Sanguisorba (*see* Poterium).

Saponaria orientalis, L., Orient.

Satureja hortensis, L., Taur., Caucas.
montana, L., S. Eur.

Saxifraga altissima, Kerner, Eur.
aphylla, Sternb., Eur.
— var. leptophylla.
— var. virescens.
aquatica, Lap., Eur.
Aizoon, L., Eur., Alps.
— var. Churchillii, Kern.
— var. Gaudinii.
— var. incrustata.
— var. infracta.
— var. minor.
— var. pectinata, Schott.
— var. pygmæa.
— var. recta, (Lap.)
— var. rotata.
— var. rosularis, Schleich.
cæspitosa, L., Eur., etc.
— var. decipiens, (Ehrh.)

**Saxifraga**—*cont.*
— var. hirta, (Don.)
— var. sedoides, (L.)
Cotyledon, L., Eur., Alps.
— var. pyramidalis, (Lap.)
crustata, Vent., Alps.
diversifolia, Wall., Himal.
Hostii, Tausch, Alps.
— var. macnabiana, Hort.
— var. tristis.
kolenatiana, Regel, Siberia.
lactea, Turcz., Temp. Asia.
lasiophylla, Schott., Europe.
lingulata, Bell., Marit. Alps.
— var. cochlearis, (Rchb.)
— var. lantoscana, (Boiss.)
longifolia, Lap., Pyrenees.
muscoides, Wulf., Eur.
— var. pygmæa, (Haw.)
Prostii, Sternb., Eur.
rocheliana, Sternb., Bosnia.
— var. coriophylla, (Griseb.)
rotundifolia, L., Eur.
— var. hirsuta.
tenella, Wulf., Alps.
trifurcata, Schrad., N. Spain.
valdensis, DC., Savoy, Alps.

Scabiosa atropurpurea, L., Eur.
caucasica, Bbrst., Cauc.
— var. amœna, (Jacq.)
micrantha, Dsf., Maced.
Portae, Huter., Eur.
vestina, Facch., Eur.

Scandix Balansæ, Reut., Orient.
brachycarpa, Guss., Sicily.
macroryncha, C. A. Mey., Eur.
Pecten-Veneris, L., Eur.

Schizanthus pinnatus, R. et P., Chili.

Schizopetalum Walkeri, Sims, Chili.

Scilla campanulata, Ait., Spain, etc.
(S. hispanica, Mill.)
— var. alba, Hort.
— var. rubra.
verna, Huds., W. Eur.

Scirpus Caricis, Retz., Eur. (Blysmus compressus, Panz.)
setaceus, L., Eur.

Schismus marginatus, Beauv., S. Eur.

Scleranthus annuus, L., Eur.
perennis, L., Eur.

Scorpiurus vermiculata, L., Eur.

Scrophularia Ehrhartii, Stev., Caucas.
nodosa, L., Eur.
— var. serrulata.
Scorodonia, L., Eur.

Scutellaria alpina, L., Eur.
— var. versicolor.
altissima, L., Caucas.

Secale Cereale, L., Asia Minor.
— var. villosum.
montanum, Guss., Sicily.

Sedum Aizoon, L., Siberia.
Ewersii, Ledeb., Siber.
heterodontum, Hk. f., Himal.
middendorfianum, Max., Siberia.
Rhodiola, DC., Siber.
(Rhodiola sibirica, Sweet.)

Selinum Candollei, DC., Nepal.

Sempervivum boutignyanum, Bill., Pyrenees.
mettenianum, Lehm., Switz.
montanum, L., Alps.

Senecio artemisiæfolius, Pers., S. Eur.
Clusii, Schultz., Eur.
elegans, L., Cape.
— var. alba.
— var. purpurea
macrophyllus, Bbrst., Caucas.
squalidus, L., Eur., etc.
thyrsoideus, DC., Siberia.
(Ligularia thyrsoidea, DC.)
viscosus, L., Eur.

Serratula coronata, L., Siberia.
— var. macrophylla.
Gmelinii, Ledeb., Caucas.
quinquefolia, Bbrst., Caucas.

Seseli gummiferum, Sm., Greece.
Hippomarathrum, L., S. Eur.

Setaria glauca, Beauv., Eur.
italica, Beauv., Eur.
(S. germanica, Beauv.)
macrochæta, Link, Eur., Asia, etc.
viridis, Beauv.

Sherardia arvensis, L., Eur.

Sibbaldia (*see* Potentilla).

Sicyos Baderoa, Hk. et Arn., Chili.

Sidalcea malvæflora, Gr., Amer.
(S. oregana, Gr.)

Silene Armeria, L., Eur.
— var. compacta, (Hornem.)
Chouleti, Coss., Eur.
ciliata, Pourr., Crete.
clandestina, Jacq., Cape.
colorata, Poir., Mediter.
conoidea, L., Levant, etc.
cretica, L., Eur.
Cucubalus, Wibel., Eur.
diurniflora, Kunze, Cape.
echinata, Otth., Italy.
fimbriata, Sims., Crete, etc.
Fortunei, Vis., China.
fusca, Link, Portugal.
gallica, L., Eur.
— var.
gigantea, L., Eur.
glauca, Pourr., Eur.
gracilis, DC.
italica, Pers., Eur.
juvenalis, Del., Egypt.
linicola, Gmel., Germany.
longicilia, Otth, Portugal.
micropetala, Lag., Eur.
muscipula, L., Mediter.
nocturna, L., S. Eur.
nutans, L., Eur.
obtusifolia, Willd., Italy.
paradoxa, L., S. Eur.
pendula, L., Sicily, etc.
Persoonii, Tod. non Schott.
pseudo-atocion, Desf., N. Afr.
quadrifida, L., Eur.
rubella, L., Eur., N. Afr.
Sartori, Boiss., Greece.
Saxifraga, L., Eur.
sedoides, Jacq., Crete.
tatarica, Pers., Tatar.
tenuifolia, Otth., Dahur.
trinervia, S. et S., S. Eur.
vesiculifera, Gay, S. Eur.
vespertina, Retz., S. Eur.
Zawadskii, Herbich., Austria.

Silybum eburneum, Coss. et Dur., Eur.
marianum, Gærtner, Eur.

Sisymbrium Alliaria, Scop., Eur.
assoanum, Losc., Eur.
austriacum, Jacq., S. Eur.
myriophyllum, H. B. K., Quito.
officinale, Scop., S. Eur.
polyceratium, L., Eur.
strictissimum, L., Eur.

Sium angustifolium, L., Eur.

Smyrnium Olusatrum, L., Eur.

Solanum Dulcamara, L., Eur.
guineense, Lam., Trop. Afr., etc.
villosum, Lam., Eur.

Solidago canadensis, L., N. Amer.

Sonchus palustris, L., Eur.

Specularia falcata, A.DC., Mediter.
— var. castellana, Lange.
pentagonia, A.DC., Orient.
perfoliata, DC., N. Amer.
Speculum, A.DC., Eur.

Spergula arvensis, L., Eur.

Sphenogyne (*see* Ursinia).

Spiræa astilboides, Hort.
Aruncus, L., N. Amer.
digitata, Willd., Siber., etc.
lobata, Jacq., N. Amer.
palmata, Thunb., Japan.

Stachys alpina, L., Eur.
— var. intermedia.
grandiflora, Bth., Caucas., etc.
(Betonica grandiflora, L.)
spinulosa, Sib. et Sm., Greece.
sylvatica, L., Eur.

Statice gougetiana, Girard, Spain.
Limonium, L., Eur.
— var. alba, Hort.
— var. puberula.
— var. Smithii, Hort.
lychnidifolia, Gir., S. Eur.
Suworowii, Regel., Turkestan.
tomentella, Boiss., Eur., etc.
(S. sareptana, Beck.)

Stipa barbata, Desf., N. Afr.
gigantea, Lag., Spain.

Swertia perennis, L., Eur. Cauc.

Symphyandra Wanneri, Heuff.

Syrenia lamarckiana, Andrz., Russia, Siberia.

Tagetes lucida, Cav., Mexico.
patula, L., Mexico.
pusilla, H B., Quito.

Tamus communis, L., Eur.

Taraxacum corniculatum, DC., Eur.
gymnanthum, DC., Eur.

Tellima grandiflora, R.Br., N. Amer.

Tetragonia expansa, Murr., Austral.

Tetragonolobus purpureus, Mœnch., S. Eur.

Teucrium Chamædrys, L., Eur.
— var. folio-aurea.
Scorodonia, L., Eur.
— var. variegatum.

Thalictrum angustifolium, Jacq., S. Eur.
— var. (T. nigricans, DC.), Eur.
aquilegifolium, L., Eur., etc.
— var. purpureum.
flavum, L., Eur.
— var.
— var. sphærocarpum, Lej.
glaucum, Desf., S. Eur.
javanicum, Blume, Java.
minus, L., Eur.
— Indian form.
— var. affine, (Jord.).
— var. collinum, (Wallr.)
— var. elatum, Regel.
trigynum, Fisch., Dahur.

Thermopsis montana, Nutt., N. Amer.
(fabacéa, DC.)

Thlaspi alliaceum, L., Eur.
arvense, L., Eur.
alpestre, L., Eur.
præcox, Wulf., Austria.

Thrincia hirta, DC., Eur.
tuberosa, DC., S. Eur.

Thymus comosus, Heuff., Transs.

Tolmiea Menziesii, Torr. et Gray, N. Amer.

Trachymene cœrulea, Graham, Austral.
pilosa, Sm., Austral.

Tradescantia erecta, Jacq., Mexico.
virginica, L., N. Amer.

Tragopogon (Geropogon glabrum, L.), S. Eur.
orientale, L., Eur., etc.

Trifolium agrarium, L., Eur.
badium, Schreb., Eur.
diffusum, Ehrh., Eur.
Lagrangei, Boiss., Orient.
leucanthum, Bbrst., Tauria, etc.
michelianum, Sav., Eur.
multistriatum, Koch, Eur.
pannonicum, L., Eur., etc.
Perreymondi, Gren., France.
resupinatum, L., Eur.
rubens, L., Eur.
squarrosa, L., S. Eur.
(panormitanum, Pr.)

Triglochin maritimum, L., Eur.

Trigonella corniculata, L., S. Eur.
cretica, Boiss., Crete.
fœnum-græcum, L., S. Eur.
ovalis, Boiss., Spain.
polycerata, L., Eur.
(T. orthoceras, Kar. et Kir., Altai.)

Trinia Kitaibelii, Bbrst., Russia, etc.

Tripteris cheiranthifolia, Schultz., Abyss.

Triticum caninum, L., Eur.
durum, Desf., S. Eur., N. Afr.
monococcum, L., Eur.
ovatum, G. et G., Eur.
polonicum, L.
spelta, L.
villosum, Beauv., S. Eur.
vulgare, Vill., Asia.

Tritonia crocosmaeflora, Garden Hybrid.
Pottsii, Benth., Cape.

Trollius asiaticus, L., Siber.
europæus, L., Eur.

Tropæolum aduncum, Sm., Peru, etc. (T. peregrinum, Jacq. T. canariense, Hort.)
majus, L., Peru.
minus, L., Peru.

Tulipa australis, Link, S. Eur.

Tyrimnus leucographus, Cass., S. Eur.

Urospermum picroides, Desf., S. Eur.

Ursinia pulchra, N. E. Brown, Cape. (Sphenogyne speciosa, Know. et West.)
— var. sulphurea, Hort., Kew.

Urtica dioica, L., Eur.

Valeriana alliariæfolia, Vahl, Caucas.
— var. intermedia.
montana, L., Eur.
officinalis, L., Eur.
— var. exaltata, (Mikan.)
— var. sambucifolia, (Mikan.)
Phu, L., S. Eur.
— var. aureo-variegata.

Valerianella Auricula, DC., Eur.
carinata, Loisl., S. Eur.
cymbaecarpa, C. A. Mey., Caucas.
eriocarpa, Desv., Eur.
hamata, DC., S. Eur.
Morisonii, DC., Eur. Taur.
olitoria, Mœnch., Eur.

Veratrum album, L., Eur.
nigrum, L., Eur.

Verbascum Blattaria, L., Eur.
phœniceum, L., Eur. Siber.

Verbena biserrata, H. B., Mexico.

Veronica anagallis, L., Eur.
incana, L., S. Eur., etc.
longifolia, L., C. et S. Eur.
— var. mollis.
— var. rosea.
maritima, L., Eur.
— var. variegata.
saxatilis, L., Eur.
serpyllifolia, L., Eur.
spicata, L., Eur., etc.
Teucrium, L., Eur.
— var. latifolia, (L.)
virginica, L., N. Amer.
— var. japonica, (Steud.)

Vesicaria corymbosa, Hort.
cretica, Poir., Crete.
edentula, Poir., Eur.

Vicia amphicarpa, Dorth., France.
calcarata, Desf., Algiers.
cassubica, L., S. Eur.
disperma, DC., France.
Ervilia, Willd., S. Eur.
Faba, L., cultivated.
— var. equina, (Pers.)
fulgens, Hort.
narbonensis, L., S. Eur.
onobrychioides, L., Eur.
sativa, L., Eur., etc.
— var. morisiana, (Jord.)
sepium, L., Eur.
sicula, Guss., Eur.
sitchensis, Bong., N. Amer., etc. (V. gigantea, Hook.)
sylvatica, L., Eur.
unijuga, A. Braun., Siberia. (Orobus lathyroides, L.)
— var. compacta, Hort., Kew.
villosa, Roth., S. Eur.

Vincetoxicum fuscatum, Rch. f., Eur.

Viola cornuta, L., Eur.
— var. alba.
Jooi, Janka, Transylv.
odorata, L., Eur.
palustris, L., Eur.
reichenbachiana, Bor., Eur.

Whitlavia (*see* Phacelia).

Wulfenia carinthiaca, Jacq., Carinth.

Xanthium indicum, Wall., Ind., etc. (X. orientale, L.)
strumarium, L., Eur.

Xanthocephalum gymnospermoides, B. et Hk. f., Arizona.

Zinnia elegans, Jacq., Mexico.

Ziziphora capitata, L., Taur., etc.

Zollikoferia elquinensis, Phil., Chili.

Zygadenus elegans, Pursh, N. Amer.

# TREES AND SHRUBS.

Abies Pindrow, Spach, Himalaya.

Acer campestre, L.
- — var. hebecarpum, Hort.
- — var. leiocarpum.
- circinatum, Pursh., N. W. Amer.
- insigne, Hort.
- (A. velutinum, Hort.)
- Lobelii, Ten., S. Eur.
- macrophyllum, Pursh., N. W. Amer.
- neapolitanum, Ten., Eur.
- obtusatum, Kit., Eur.
- platanoides, L., Eur.
- Pseudo-Platanus, L., Eur., etc.
- — var. euchlorum.
- — var. flavo-marginatum, Hort.
- — var. fol. variegatum, Hort.
- — var. lutescens, Hort.
- — var. purpureum, Hort.

Alnus cordifolia, Ten., Italy.
- firma, S. et Z., Japan.
- glutinosa, Gærtn.
- — var. rubronervia, Hort.
- — var. sorbifolia, Hort.
- incana, Will., N. Hemisphere.
- — var. glauca, (Ait.)
- — var. laciniata, Hort.
- japonica, S. et Z., Japan.
- orientalis, Dcne., Orient.
- rubra, Bong., N. W. Am.
- serrulata, Willd., N. Am.
- —var. latifolia, Hort.

Amelanchier Botryapium, DC.
- — var. sanguinea.

Amorpha fruticosa, L., N. Amer.

Aralia edulis, S. et Z., Japan.

Aucuba japonica, Thunb.
- vera, Hort.

Azalea (garden hybrids).

Berberis aristata, DC., Himal.
- buxifolia, Lamk., Chili.
- canadensis, Mill., N. Amer.
- Darwinii, Hook. f., Chili.
- sinensis, Desf., China.
- stenophylla, Hort.
- Thunbergii, DC., Japan.
- virescens, Hook. f., Himalaya.
- vulgaris, L., Eur., etc.
- — var. emarginata, Hort.
- — var. iberica, (Stev.)
- — var. lucida, (Schrad.)
- — var. purpurea, Hort.
- — var. sanguinolenta, Hort.
- — var. spathulata, (Schrad.)
- — var. violacea, Hort.
- wallichiana, DC., Himal.

Betula alba, L., N. Hemisph.
- — var. Youngii, Hort.
- corylifolia, S. et Z., Japan.
- lenta, L., N. Amer.
- lutea, Michx. f., N. Amer.
- papyracea, Ait., N. Amer.
- populifolia, U. S. Amer.
- ulmifolia, S. et Z., Japan.

Buddleia japonica, Hemsl., Japan.

Biota orientalis, End., Orient.
- — var. gracilis, Hort.
- — var. intermedia, Hort.
- — var. pyramidalis, Hort.

Buxus sempervirens, L., Eur. Asia.
- — var. latifolia, Hort.
- — var. prostrata, Hort.

Caragana arborescens, Lamb., Siberia.
- frutescens, DC., Siberia.
- — var. pendula, Hort.
- pygmæa, DC., Siberia.
- Redowskii, DC., Siberia.

Carpinus Betulus, L., Eur., etc.

Cedrus Deodara, Loud., Himal.

Celtis occidentalis, L., N. Amer.

Cerasus lusitanica, Lobel., Portugal.
Laurocerasus, Lois.
— var. caucasicus.

Cercis Siliquastrum, L., Mediterr. Region.

Chamaecyparis (Cupressus).
lawsoniana, Parl., Calif.
— var. albo-spica, Hort.
— var argentea, Hort.
— var. californica, Hort.
— var. fragrans argentea, Hort.
— var. gracilis pendula, Hort.
— var. intertexta, Hort.
— var. ochroleuca, Hort.
obtusa, S. et Z., Japan. (Retinospora obtusa.)

Cistus laurifolius, L., Spain.

Cladrastis amurensis, Benth. et Hook., Amur.

Clematis erecta, L., Europe, etc.
Flammula, L. Europe.
Pitcherii, Torr. et Gray, N. Amer.

Colutea arborescens, L., Eur.
— var. cruenta, (Ait.)
— var. haleppica, (Lamk.)

Cornus alba, L., N. Amer.
pubescens, Nutt., N. Amer.
sanguinea, L., Eur.
sericea, L., N. Amer.

Cotoneaster acuminata, Lindl., Himal.
bacillaris, Wall., Himal.
— var. floribunda, Hort.
— var. obtusa, Hort.
buxifolia, Wall., Himal.
frigida, Wall., Himal.
horizontalis, Dcne.
microphylla, Wall., Himal.
nummularia, F. et M., Asia, etc.
rotundifolia, Wall., Himal.
Simonsii, Baker., Himal.
tomentosa, Lindl., Eur.

Crataegus Carrierei, Vauvel. (C. Lavallei, Herincq.)
coccinea, L., N. Amer.
— var. acerifolia, Hort.
— var. corallina, Hort.

Crataegus—*cont.*
— var. glandulosa, Hort.
— var. indentata, Hort.
— var. Kelmanni, Hort.
— var. subvillosa, Hort.
cordata, Mill., N. Amer.
Crus-Galli, L., N. Amer.
— var. prunifolia, (Pers.)
Douglasii, Lindl., N. Amer.
Downingii, Hort.
flava, Ait. var. lobata, Lindl. N. Amer.
heterophylla, Flugge.
macracantha, Lodd.
nigra, W. et K., E. Eur.
orientalis, Pall., Orient.
Oxyacantha, L., Eur.
— var. eriocarpa, Hort.
— var. flexuosa, Hort.
— var. fusca, Hort.
— var. Gumperi bicolor, Hort.
— var. monogyna, (Jacq.)
— var. obtusata, Hort.
— var. pendula, Hort.
— var. pentagyna, Hort.
— var. punicea, Hort.
— var. Reginæ, Hort.
— var. spinosissima, Hort.
— var. stricta, Hort.
parvifolia, Ait., N. Amer.
punctata, Jacq., N. Amer.
— var. aurea, Hort.
— var. brevispina, Hort.
— var. striata, Hort.
Pyracantha, Pers., var. Lalandii, Hort.
sanguinea, Pall., Siberia, etc.
— var. songorica.
tanacetifolia, Pers., Orient.
tomentosa, L., N. Amer.

Cytisus albus, L., S. W. Eur.
— var. incarnatus, Hort.
capitatus, Jacq., S. Eur.
biflorus, L., Herit., Eur.
hirsutus, L., S. Eur.
leucanthus, W. et K., E. Eur.
× præcox, Hort.
nigricans, L., Eur.
— var. longispicatus.
purpureus, Scop., E. Eur.
scoparius, L., Eur.
— var. pendula, Hort.
sessilifolius, L. Eur.

Cytisus—*cont.*
supinus, Jacq., S. Eur.
uralensis.

Dabœcia polifolia, D. Don., W. Eur.
— var. alba.
— var. versicolor.

Deutzia crenata, S. et Z., Japan.
— var. punctata.
— var. Sieboldii, Hort.
scabra, Thunb., Japan.

Elaeagnus argentea, Pursh., N. W. Amer.
japonicus, Hort.
longipes, A. Gray., Japan.
umbellata, Thunb., Japan.

Erica cinerea, L., var. atrosanguinea.
— var. coccinea.
— var. grandiflora.
— var. purpurea.
— var. rosea.
stricta, Andr., S. Eur.

Euonymus americanus, L., var. obovatus, Torr., Gr. N. Amer.
europaeus, L., Eur.
— var. coccineus, Hort.
latifolius, Scop., Eur.

Forsythia suspensa, Vahl., Japan, etc.

Fraxinus Ornus, L., Eur.
— var. latifolia, Hort.
— var. rotundifolia, Hort.
excelsior, L., var. simplicifolia, Hort.

Gaultheria Shallon, Pursh., N. Amer.

Genista ætnensis, DC., Sicily.
hispanica, L., S.W. Eur.
pilosa, L. Eur.
radiata, Scop., S. Eur.
sagittalis, L., Eur.
tinctoria, L., var. elatior.
virgata, DC., Madeira.

Halesia tetraptera, L., United States.

Hamamelis virginica, L., N. Amer.

Hedera Helix, L., Eur., etc.
— var. arborea fol. aur., Hort.

Hippophæ rhamnoides, L., Eur., etc.

Hydrangea nivea, Michx., N. Amer.

Hypericum Androsaemum, L., Eur.
elatum, Ait., N. Amer.

Ilex Aquifolium, L., Eur.
— var. ciliata, Hort.
— var. platyphylla, Hort.
verticillata, Gray., N. Amer.

Kalmia glauca, Ait., N. Amer.
latifolia, L., N. Amer.

Laburnum Adami, Lav. (Laburnum × Cytisus purpureus.)
alpinum, Griseb., Eur.
Alschingeri, Vis., E. Eur.
vulgare, Griseb., Eur.
— var. aureum, Hort.
— var. Carlieri, Hort.
— var. involutum, Hort.
— var. Parkesi, Hort.
— var. quercifolium.
— var. sessilifolium.

Ledum palustre, L., Eur., etc.
latifolium, Ait., N. Amer.

Leycesteria formosa, Wall., Himal.

Ligustrum vulgare, L., Eur. etc.

Lonicera discolor, Lindl., Himal.
Morrowii, Gray., Japan.
occidentaliis, Steud., N. Am.
tatarica, L., var. kamtschatica, Hort.
Xylosteum, L., Eur.

Lyonia ligustrina, DC., N. Amer.

Mahonia Aquifolium, Nutt.
— var. murrayana, Hort.
fascicularis, DC., N. Amer.
japonica, DC., Japan.

Menispermum canadense, L., N. Amer.

Mespilus Smithii, DC., Caucasus.

Morus nigra, L., Eur.

Myrica cerifera, L., United States.

Neillia amurensis (Spiræa, Maxim.), Amurland.
opulifolia, Benth. et Hook., N. Amer.
— var. lutea, Hort.
— var. nana, Hort.

Olearia Haastii, Hook. fil., N. Zeal.
Pernettya mucronata, Gaud., Chili, etc.
Prunus brigantiaca, Vill., S. Eur.
Ptelea trifoliata, L., N. Amer.
— var. aurea, Hort.
— var. glauca, Hort.
Pyrus americana, DC., N. Amer.
Aria, Ehrh.
— var. græca, Boiss.
— var. salicifolia.
arbutifolia, L., N. Amer.
— var. erythrocarpa, Gr.
— var. grandiflora, Hort.
— var. serotina, Lindl.
Aucuparia, Gaertn., Eur.
— var. pendula, Hort.
— var. saturejifolia.
domestica, Sm., var. maliformis.
— var. piriformis.
floribunda, Sieb., Japan.
latifolia, Syme.
Maulei, Masters, Japan.
— var. superba, Hort.
Ringo, Max., Japan, etc.
spectabilis, Desf., China, etc.
Rhamnus alnifolius, L., N. Amer.
carolinianus, Walt., S., United States.
infectorius, L., S. Eur.
latifolius, L'Herit. Azores.
Wicklius, Hort.
Rhodotypus kerrioides, S. et Z., Japan.
Rhus Cotinus, L., Eur.
radicans, L., N. Amer.
typhina, L., N. Amer.
Ribes alpinum, L., Eur.
— var. laciniatum, Hort.
— var. opulifolium, Hort.
— var. pumilum, Hort.
aureum, Pursh., var. praecox, Hort.
nigrum, L., N. Eur.
palmatum, Desf., N. Amer.
sanguineum, Pursh., N.W. Amer.
— var. albidum.
— var. atrorubens, Hort.
— var. atrosanguineum, Hort.
— var. glutinosum, Benth.
Rosa acicularis, Lindl., Japan, etc.
agrestis, Savi, Eur.
Alberti, Rgl., E. Asia.
alpina, L., Eur.
— var. inermis.
Bakeri, Desegl., England.
belgradensis, Hort.
californica, Ch. et Sch., Calif.
canina, L., Eur., etc.
— var. andegavensis, Baker.
carolina, L., N. Amer.
cinnamomea, L., Eur., etc.
gallica, L., Eur., var.
hibernica, Sm., Britain.
— var. vera.
lucida, Ehrh., N. Amer.
microcarpa, Hort.
microphylla, Roxb., China.
mollis, Sm., Eur.
moschata, Mill., India, etc. (R. Brunoni, Lindl.)
multiflora, Thunb., Japan.
nutkana, Presl., N. Amer.
omissa, Déségl., Eur.
pisocarpa, A. Gray, N. Amer.
rubiginosa, L., Europe, etc.
— var. major, Hort.
rubrifolia, Vill., Eur.
rugosa, S. et Z., Japan.
— var. alba.
sericea, Lindl., Himal.
spinosissima, L., Eur.
— var. cistiflora, Hort.
— var. picta, Hort.
— var. pusilla, Hort.
— var. rubra, Hort.
tomentosa, Sm., Eur., etc.
— var. dimorpha.
— var.
Wilsoni, Bor., Britain.
Rubus balfourianus, Blox., Eur.
calvatus, Blox., Britain.
cordifolius, W. et N., Eur.
laciniatus, Willd., Hort.
leucostachys, Sm., Eur.
lindleyanus, Lees, Eur.
mucronatus, Blox., Eur.
occidentalis, L. et N., Amer.
rhamnifolius, W. et N., Eur.
rudis, W. et N., Eur.
strigosus, Michx., N. Amer.
thyrsoideus, Wimm., Eur.
ulmifolia, Schott (R. discolor, W. et N.), Eur.
villicaulis, Koehl., Eur.

Sambucus canadensis, L., N. Amer.
nigra, L., Eur.
— var. aurea, Hort.
— var. laciniata, Hort.
— var. melanocarpa, Hort.
— var. rotundifolia, Hort.
— var. swindonensis, Hort.
— var. virescens, Hort.

Santolina viridis, L., W. Eur.

Skimmia Fortunei, Mast. (S. japonica, Hort.)

Smilax rotundifolia, L., N. Amer.

Spartium junceum, L., S. Eur.

Spiraea canescens, Don., Himal.
carpinifolia, Pall., Eur.
Douglasii, Hook., N.W. Amer.
hypericifolia, L., Eur.
japonica, L. fil., Japan.
— var. flore albo.
— var. glabra, Hort.
— var. typica.
— var. ruberrima, Hort.
lindleyana, Wall., Himal.
luxurians, Lavallée (S. pruinosa, Hort.).
paniculata, L.
— var. rosea.
salicifolia, L., N. Amer.
splendens, Hort.

Staphylea pinnata, L., Eur.

Symphoricarpus racemosus, Michx., N. Amer.

Syringa Emodi, Wall., Himal.
vulgaris, L., Orient.

Taxus baccata, L., Eur., etc.
— var. adpressa.
— var. Dovastonii, Hort.
— var. fructu-luteo, Hort.
— var. Washingtoni, Hort.

Thuja Dicksoni, Hort.
gigantea, Nutt., N.W. Amer.
occidentalis, L., N. Amer.

Ulex europaeus, L., Eur.

Vaccinium maderense, Link., Azores.

Viburnum Opulus, L., Eur., etc.
— var. edule, Hort.
— var. fructu-luteo, Hort.
— var. roseum, Hort.
cassinoides, N. Amer.
Lantana, L. Eur.

Zenobia speciosa, D. Don., U. S. Amer.
— var. pulverulenta.

ROYAL GARDENS, KEW.

# BULLETIN

OF

# MISCELLANEOUS INFORMATION.

APPENDIX II.—1892.

## NEW GARDEN PLANTS OF THE YEAR 1891.

The number of garden plants annually described in botanical and horticultural publications, both English and foreign, is now so considerable that it has been thought desirable to publish a complete list of them in the *Kew Bulletin* each year. The following list comprises all the new introductions recorded during 1891. These lists are indispensable to the maintenance of a correct nomenclature, especially in the smaller botanical establishments in correspondence with Kew, which are, as a rule, only scantily provided with horticultural periodicals. Such a list will also afford information respecting new plants under cultivation at this establishment, many of which will be distributed from it in the regular course of exchange with other botanic gardens.

The present list includes not only plants brought into cultivation for the first time during 1891, but the most noteworthy of those which have been re-introduced after being lost from cultivation. Other plants included in the list have been in gardens for several years, but either were not described or their names had not been authenticated until recently.

In addition to species and botanical varieties, all hybrids, whether introduced or of garden origin, but described for the first time in 1891, are included. Mere garden varieties of such plants as Coleus, Codiæum, or Narcissus are omitted for obvious reasons.

In every case the plant is cited under its published name, although some of the names are doubtfully correct. Where, however, a correction has appeared desirable this is made.

The name of the person in whose collection the plant was first noticed or described is given where known.

An asterisk is prefixed to all those plants of which examples are in cultivation at Kew.

The publications from which this list is compiled, with the abbreviations used to indicate them, are as follows:—*B. M.*—Botanical Magazine. *B. T. O.*—Bullettino della R. Società Toscana di Orticultura. *Bull Cat.*—Bull, Catalogue of New, Beautiful, and Rare Plants. *Gard.*—The Garden. *G. C.*—Gardeners' Chronicle. *G. and F.*—Garden and Forest. *Gfl.*—Gartenflora. *G. M.*—Gardeners' Magazine. *Ill. H.*—L'Illustration Horticole. *Jard.*—Le Jardin. *J. of H.*—

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Journal of Horticulture. *L.*—Lindenia. *O.*—L'Orchidophile. *R.*—Reichenbachia. *R. H.*—Revue Horticole. *R. H. B.*—Revue de l'Horticulture Belge. *Veitch Cat.*—Veitch & Sons, Catalogue of Plants. *W. G.*—Wiener Illustrirte Garten-Zeitung. *Williams Cat.*—Williams, New and General Plant Catalogue. *W. O. A.*—Warner & Williams, Orchid Album.

The abbreviations used in the descriptions of the plants are: —*Diam.* —Diameter. *Fl.*—Flower. *Fr.*—Fruit. *Ft.*—Foot or Feet. *G.*—Greenhouse. *H.*—Hardy. *H. H.*—Half-hardy. *In.*—Inches. *Infl.* —Inflorescence. *L.*—Leaves. *Lin.*—Line (one-twelfth of an inch). *Per.*—Perennial. *S.*—Stove. *Pet.*—Petals. *Sep.*—Sepals. *Shr.*—Shrub.

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**Acampe madagascariensis,** Kränzlin. (*G. C.* 1891, x., p. 608.) Orchideæ. S. A new species allied to *A. papillosum.* It has thick leathery leaves and small whitish flowers, the lip rose-purple. Madagascar. (Sander & Co.)

***Ada Lehmanni,** Rolfe. (*G. C.* 1891, x., p. 34.) Orchideæ. S. A new species with the habit of *A. aurantiaca*, Ldl., but more rigid. Sepals and petals orange, lip white with a yellow callus. Colombia. (Kew; Glasnevin, &c.)

**Aeranthus brachycentron,** Regel. (*Gfl.* 1891, p. 323; *G. and F.* 1891, iv., p. 365.) Orchideæ. S. This scarcely differs from *A. grandiflorus* of Lindley.

**Aerides Lawrenceæ,** Rchb. f. var. **amesiana,** Sander. (*G. C.* 1891, x., p. 393.) Orchideæ. S. A variety with flowerstalks more than 2 ft. long, crowded with richly coloured flowers larger than those of the type. (Sander & Co.)

***Aerides savageanum,** Sander ex Veitch. (*Veitch Man.* pt. 7, p. 78.) S. A pretty species, with racemes of moderate sized fl., white, tipped and dotted with crimson-purple. (Sander & Co.)

**Aerides suavissimum,** Ldl. var. **blandum,** Kranzl. (*Gfl.* 1891, p. 576.) S. A variety without spots on the fl. (Sander & Co.)

***Alberta magna,** E. Mey. (*Bull Cat.* 1891, p. 3.) Rubiaceæ. G. or S. A very ornamental shr. with deep green shining l., and panicles of tubular red fl., succeeded by winged fr. of a red colour, forming a conspicuous object. Has not yet flowered in England. Natal. (W. Bull.)

**Allamanda Williamsii,** Hort. (*G. C.* 1891, x., p. 111; *G. and F.* 1891, iv., p. 376; *J. of H.* 1891, xxiii., fig. 14; *Gard.* xl., pl. 832.) Apocynaceæ. S. A variety of *A. cathartica.* It differs from ordinary garden kinds in being of erect habit. (Williams & Son.)

**Alocasia conspicua,** André. (*R. H.* 1891, pp. 175, 367.) Aroideæ. S. A garden hybrid between *A. odora* and *A. Putzeysii.* (Marquis of Corsi, Florence; Chantrier Frères.)

**Alocasia mortfontanensis,** André. (*R. H.* 1891, p. 174.) S. A garden hybrid between *A. Lowii* and *A. sanderiana.* (Chantrier Frères.)

**Alocasia rodigasiana,** André. (*R. H.* 1891, p. 174.) S. A garden hybrid between *A. Thibauti* and *A. Reginæ.* (Chantrier Frères.)

**Ampelovitis intermedia,** Carr. (*R. H.* 1891, p. 334.) Ampelideæ. H. Vine of vigorous growth with the stems and petioles beset with stout bristles. The l. are large, coriaceous, and vary from cordate entire to palmately 5-lobed.

***Angræcum fragrans,** Spreng. (*B. M.* t. 7161; *G. and F.* iv., p. 103.) Orchideæ. S. An interesting little species, the leaves of which, when dry, are used as tea in Bourbon. The pure white fl. are produced singly on axillary racemes. Bourbon and Mauritius. (Kew.)

**Ansellia humilis,** Bull, and var. **pallida,** Bull. (*Bull Cat.* 1891, p. 3; *Gfl.* 1891, p. 333.) Orchideæ. S. epiphyte. A compact free growing species with large panicles of lemon-yellow fl., blotched and barred with chocolate, each about 2 in. in diam. Var. **pallida,** differs in having the ground colour of the fl. milk-white. Zambesi. (W. Bull.)

**Anthurium eburneum,** Williams. (*Williams Cat.* 1891, p. 24.) Aroideæ, S. A garden hybrid between *A. andreanum* and *A. ornatum.* (Williams & Son.)

**Anthurium Paradisæ,** Williams. (*Williams Cat.* 1891, p. 24.) S. A garden hybrid between *A. andreanum* and *A. ornatum.* (Williams & Son.)

**Anthurium ridolfianum album,** Pucci. (*B. T. O.* 1891, p. 244, t. 8.) S. per. A garden hybrid with a large white spathe and pink spadix. Origin not known. (Marquis Carlo Ridolfi.)

**Anthurium rotundispathum,** Lind. & Rod. (*Ill. H.* vol. 38, p. 9, pl. 119.) S. A garden hybrid between *A. andreanum* and *A. Lindeni*. (L'Horticulture Internationale.)

***Aphelandra blanchetiana,** Hook f. (*B. M.* t. 7179.) Acanthaceæ. S. This is the correct name for the plant distributed by Mr. W. Bull in 1888 as *A. amœna*.

**Aphelandra tetragona,** Nees, var. **imperialis,** Wittm. (*Gfl.* 1891, p. 449, t. 1354.) S. shr. A variety with ovate acute green l. and terminal spikes of showy scarlet-red fl. four times as long as the small brownish bracts. Central America. (Madame Borsig.)

**Appendicula peyeriana,** Kränzlin. (*G. C.* 1891, x., p. 669.) Orchideæ. S. A new species like a small Dendrobe with long slender pseudobulbs and small white flowers. Sumatra. (Ortgies, Zurich.)

**Arachnanthe Lowii,** Benth. var. **rohdeniana,** Veitch. (*Veitch Man.* part 7, p. 10.) Orchideæ. S. A dwarf form with shorter and narrower l. and brighter coloured fl., the four lower yellow ones being separated from the rest by an interval of 9–12 in. Borneo. (Duc de Massa, near Luzarches France.)

**Arisæma enneaphyllum,** Hochst. (*Gfl.* 1891, p. 578, f. 103.) Aroideæ. G. The plant figured at the place quoted appears to be **A. flavum,** Schott., and not *A. enneaphyllum*. It is a dwarf species with pedatisect l. with 5–7 leaflets. The spathe is yellow, with the limb bent forward, spadix short, clavate. Arabia. (Dammann & Co.)

***Aristolochia gigas,** Ldl. var. **Sturtevantii,** Watson. (*G. and F.* 1891, iv., p. 546.) Aristolochiaceæ. A very large flowered variety which bloomed at Kew last year, having been sent hither by E. D. Sturtevant, New Jersey.

**Arnebia macrothyrsa,** Stapf. (*W. G.* 1891, p. 128; *G. C.* 1891, vol. 9, p. 148, 180.) Boragineæ. H. per. A fine showy plant 12–18 in. high, with l. 4–7 in. long and a large head of yellow fl. Armenia. (Thompson; Haage & Schmidt.)

**Arum syriacum,** Sprenger. (*Gfl.* 1891, p. 657, f. 124.) Aroideæ. H. H. per. This seems to be the same as **Biarum carduchorum,** Engl. The tuber produces a small cluster of short spatulate-lanceolate l., from the centre of which arises a subsessile spathe 5–6 in. long, blackish-purple within, green spotted with purple outside; spadix slender, nearly as long as the spathe, blackish. Syria. (Dammann & Co.)

***Bauhinia Galpini,** N. E. Brown. (*G.C.* 1891, ix., p. 728; *Icones Plantarum*, t. 1994.) Leguminosæ. G. A new species recently introduced to Kew from the Transvaal. It is a dwarf shrub with two-lobed leaves and racemes of large handsome crimson flowers. It has not yet flowered in cultivation.

**Begonia bicolor,** S. Wats. (*W. G.* 1891, p. 137, t. 1; *B. T. O.* 1891, p. 189.) Begoniaceæ. G. A tall erect-growing species, with broad obliquely-reniform l., green spotted with white, the upper ones with bulbils in their axils. The fl. are bright rose, disposed in a terminal raceme, the peduncles being 1–3 flowered. Mexico. (Horsford & Co., Charlotte, Vermont, U.S.; Zabel.)

**Begonia pictaviense,** Bruant. (*W. G.* 1891, p. 155.) S. A garden hybrid between *B. scharffiana* and *B. metallica*. (Bruant.)

**Billbergia intermedia,** Witte. (*Gfl.* 1891, p. 563, f. 101.) S. A garden hybrid between *B. nutans* and *B. vittata*. (Leyden Botanic Garden.)

**Billbergia leodiensis,** Witte. (*Gfl.* 1891, p. 563, f. 100.) S. A garden hybrid between *B. vittata* and *B. nutans*. (Leyden Botanic Garden.)

**Billbergia wittmackiana,** Witte. (*Gfl.* 1891, p. 328, f. 69.) S. A garden hybrid between *B. vittata* and *B. amœna*. (Leyden Botanic Garden.)

***Brownea Crawfordii,** W. Watson. (*G. C.* 1891, ix., p. 398.) Leguminosæ. S. A hybrid between *B. grandiceps* and *B. macrophylla*, raised by the late W. H. Crawford, Cork. (Kew.)

***Bulbophyllum denticulatum;** Rolfe. (*Kew Bull.*, 1891, p. 197.) Orchideæ. S. A small species with the habit of *B. flavidum*. Sierra Leone. (Kew.)

***Bulbophyllum inflatum,** Rolfe. (*G. C.* 1891, ix., p. 234.) A new species allied to *B. comatum*, Ldl. It has 4-angled pseudobulbs with one leaf, and a pendulous scape, bearing small greenish-yellow flowers. Sierra Leone. (Kew.)

**Bulbophyllum nigripetalum,** Rolfe. (*Kew Bull.* 1891, p. 197.) S. A small species with depressed-ovoid bulbs bearing one l., and an erect subsecund fl.-spike. Fl. yellowish and purple-black. West tropical Africa. (O'Brien.)

**Caladium adamantinum,** Lind. (*Ill. H.* vol. 38, p. 71, pl. 132.) Aroideæ. S. An ornamental foliage plant with deflexed, sagittate l., dark green with white venation, and with numerous white dots along the borders of the veins. Peru. (L'Horticulture Internationale.)

**Caladium medioradiatum,** Lind. and Rod. (*Ill. H.* vol. 38, p. 51, pl. 128.) S. foliage plant. A very distinct species with peltate ovate acute l., notched at the base, of a dark green with the course of the midrib and its two branches silvery-white, the petiole is mottled with brown. Columbia. (L'Horticulture Internationale.)

**Caladium sagittatum,** Lind. and Rod. (*Ill. H.* vol. 38, p. 101, pl. 138.) S. A distinct looking species with narrow sagittate l. deeply bilobed behind, dark green with the midrib and its hind branches feathered with red. Brazil. (L'Horticulture Internationale.)

**Calampelis scabra,** Sw. var. **roseus.** (*G. C.* 1891, vol. x., p. 672.) Bignoniaceæ. H. An orange-red flowered variety of the well-known *Eccremocarpus scaber.* July, August. (J. Mahling.)

**Calanthe Eyermanii,** Hort. (*G. and F.* iv., p. 16, fig. 3.) Orchideæ. S. A hybrid between *C. vestita* and *C. Veitchii,* raised in New Jersey.

**Campanula excisa,** Schleich. (*G. C.* 1891, vol. ix., p. 340.) Campanulaceæ. H. A remarkable species somewhat resembling *C. tommasiniana.* Fl. funnel-shaped, with notches between the lobes. July. Switzerland. (Kew.)

**Caraguata beleana,** André. (*R. H.* 1891, p. 114, f. 27.) Bromeliaceæ. S. per. with bright green acuminate l., 2–2½ ft. long, lepidote beneath, and a fl.-stem about 2 ft. high with a panicle of white fl. (Dr. Le Bèle, Mans.)

**Cattleya amœna,** God. Leb. (*O.* 1891, p. 273, with pl.) Orchideæ. S. A garden hybrid between *C. Loddigesii* and *Lælia Perrinii.* (A. Bleu.)

**Cattleya crispa,** var. **delicatissima,** Williams. (*W. O. A.* vol. 19, pl. 424.) A variety with white fl., the lip veined with mauve-purple. South Brazil. (Williams & Son.)

**Cattleya gaskelliana,** var. **speciosa,** Hort. (*G. M.* 1891, Aug., p. 495.) S. A white variety with crisp margins and a rich rose-purple blotch on the labellum. (Seeger & Tropp.)

**Cattleya hardyana,** Rchb. f. var. **laversinensis,** L. Lind. (*L.* v. 7, p. 37.) S. A handsome variety having the sep. marbled with rosy-purple on a lighter ground, the pet. dark rose-purple, and a richly coloured lip. (Baron F. Rothschild.)

**Cattleya intermedia,** Ldl. var. **punctatissima,** Sand. (*R.* 2nd ser., v. 1, p. 51, t. 24; *Gfl.* 1891, p. 495.) S. A pretty form with pale rosy-white sep. and pet. dotted with rosy-purple, and a dark purple front lobe to the lip. South Brazil. (Sander & Co.)

**Cattleya lowryana,** Hort. (*G. and F.* 1891, iv., p. 293.) A supposed garden hybrid between *C. intermedia* and *C. Forbesii,* raised by F. Sander & Co.

**Cattleya Mossiæ,** var. **decora,** Williams. (*W. O. A.* vol. 19, pl. 421.) S. A form with the throat and sides of the lip yellow veined with magenta-purple. La Guayra. (Williams & Son.)

**Cattleya Parthenia,** A. Bleu. (*L.* vol. 6, p. 75, pl. 276.) S. Garden hybrid between *C. fimbriata* and *C. Mossiæ.* (A. Bleu.)

**Cattleya Vedasti,** Perr. (*O.* 1891, p. 48, with pl.) S. A garden hybrid between *C. Loddigesii* and *C. Pinelli,* var. *marginata.* (Perrenoud.)

**Cattleya warocqueana,** var. **amethystina,** L. Lind. (*L.* vol. 6, p. 59, pl. 268.) S. A very handsome form with deep rosy-purple sep. and pet., and a rich maroon-purple lip with an orange-yellow throat. (L'Horticulture Internationale.)

**Cereus sargentianus,** Orcutt. (*G. and F.* 1891, iv., p. 436, f. 69.) A new species with stems up to 15 ft. high five to six angled, spines ½ in. long in dense tufts, flowers small, pink. Lower California. (C. R. Orcutt.)

**Chionodoxa Luciliæ × Scilla bifolia.** (*Gard.* 1891, vol. 39, p. 308.) Liliaceæ. H. A curious hybrid raised by Mr. J. Allen, Shepton Mallet, but of no horticultural value. April. (Allen.)

***Cirrhopetalum Collettii,** Hemsley. (*G. C.* 1891, ix., p. 614; *B. M.* t. 7198.) Orchideæ. S. The largest and handsomest of the Indian species. Pseudobulbs, with one thick and

leathery l.; umbel 6-flowered, flowers 5 in. long, dark purple and yellow. Upper Burma. (Kew.)

**Cirrhopetalum elegantulum**, Rolfe. (*G. C.* 1891, ix., p. 552; *Gfl.* 1891, p. 359.) S. "A small species too small "to be showy, though the flowers are "pretty enough, being striped with "maroon-purple on a pale ground." Madras. (J. O'Brien.)

**Cirrhopetalum wendlandianum**, Kränzlin. (*G. C.* 1891, vol. 9, p. 612; *Gfl.* 1891, p. 360.) S. Something in the way of *C. Collettii* with an umbel of wine-purple fl., the sep. ciliate with a few trembling clavate hairs, and having tails 6–7 in. long. British Burmah. (Botanic Garden, Herrenhausen.)

**Clematis brevicaudata**, DC. Ranunculaceæ. H. This is the correct name of the plant mentioned in the Kew Bulletin List of New Plants for 1889 under the name of *C. Pieroti*, Miq. (China.)

**Cliveucharis pulchra**, Hort. (*G. C.* 1891, ix., p. 708; *W. G.* 1891, p. 274; *Gfl.* 1891, p. 416.) Amaryllidaceæ. S. A supposed bigeneric hybrid between *Clivea* and *Eucharis grandiflora*, raised by L. van Houtte, Ghent.

*__Cochlioda nœzliana__, Rolfe. (*L.* v. 6, p. 55, pl. 266; *O.* 1891, p. 290; *W. G.* 1891, p. 392; *G. and F.*, vol. 4, p. 162; *Gfl.* 1891, p. 643.) Orchideæ. S. Very similar to *C. vulcanicum*, but with rather broader pet. Syn. *Odontoglossum nœzliana*, Hort. Andes. (L'Horticulture Internationale.)

**Cocos Pynærtii**, Hort. (*G. C.* 1891, xi., p. 683; *G. and F.* iv., p. 293.) Palmæ. S. A seedling form of *C. weddeliana* differing only from the type in having narrower pinnæ. Syn. *C. sp.? minima glauca*. *Rev. de l'Hort. Belge*, 1891, xvii., p. 91, fig. 15. (F. Sander & Co.)

**Cœlogyne micholicziana**, Kränzlin. (*G. C.* 1891, x., p. 300; *Gfl.* 1891, p. 534.) Orchideæ. S. A new species allied to *C. speciosa*, flowers white with a brown callus. Macassar. (F. Sander & Co.)

**Coryanthes leucocorys**, Rolfe. (*L.* vol. 7, p. 13, pl. 293.) Orchideæ. S. A very fine and distinct species. The large sep. and pet. are greenish-yellow, marked with brown-purple, the bucket of the lip is dark purple, and the large hood is white. Peru. (L'Horticulture Internationale.)

**Crinum roozenianum**, O'Brien. (*G. C.* 1891, ix., p. 701; *Gfl.* 1891, p. 390.) Amaryllidaceæ. S. "It is near *C.* "*americanum*, although the growth is "something like that of *C. erubescens*." Flowers 4–12 in an umbel, white, filaments red. Jamaica. (A. Roozen & Co., Haarlem.)

*__Crocus biflorus__, var. **Leichtlinii**, Dewar. (*G. C.* 1891, vol. ix., p. 235.) Irideæ. H. A new variety of *C. biflorus* from Mardin, with white or pale purple fragrant flowers, having narrow lanceolate segments. (Kew.)

**Cycnoches peruvianum**, Rolfe. (*L.* v. 7, p. 29, pl. 301.) Orchideæ. S. A curious species allied to *C. ventricosum*, having a drooping raceme of pale green fl., spotted with purple-brown, and a remarkable lip, white in colour, and cut into radiating clavate processes. Peru. (L'Horticulture Internationale.)

**Cycnoches rossianum**, Rolfe. (*G. C.* 1891, ix., p. 456.) S. A new species. Male flowers on slender racemes, flowers 1½ in. diam., yellowish-green with brown spots; female raceme one-flowered, twice as large as the male, and coloured bright green. Origin unknown. (H. J. Ross, Florence.)

**Cymbidium pulcherrimum**, Hort. (*G. C.* 1891, x., p. 712.) S. A new species with grassy leaves and a stout scape bearing about a dozen waxy white flowers striped and flushed with crimson. Northern India. (F. Sander & Co.)

**Cypripedium Alcides**, Rolfe. (*G. C.* 1891, ix., p. 40.) Orchideæ. S. A hybrid between *C. hirsutissimum* and *C. insigne*, raised by F. Sander & Co.

**Cypripedium amabile**, Bleu. (*R. H.* 1891, p. 496, with plate.) S. A garden hybrid between *C. javanico-superbiens* and *C. Hookeræ*. (A. Bleu.)

**Cypripedium Berenice**, Rolfe. (*G. C.* 1891, ix., p. 136.) S. A hybrid between *C. Rœbeleni* and *C. Lowii*, raised by Captain Vipan, Wansford.

**Cypripedium bragaianum**, L. Lind. (*L.* vol. 6, p. 81, pl. 279.) S. A garden hybrid between *C. hirsutissimum*, var. *cœrulescens*, and *C. Boxallii*, var. *atratum*. (L'Horticulture Internationale.)

**Cypripedium Browni**, Hort. (*G. C.* 1891, x., p. 49.) S. A hybrid between *C. magnificum* and *C. leucorrhodum*, raised by Messrs. Pitcher & Manda, Swanley.

***Cypripedium californicum**, Gray. (*B. M.* t. 7188.) H. A small flowered pretty species inhabiting damp woods in the northern parts of California. Stem 1–2 ft. high, l. broadly ovate, nerved, fl. small, sepals dull yellow, lip white spotted with pale brown. Closely allied to *C. passerinum*. May. (W. E. Gumbleton; Kew.)

**Cypripedium Ceres**, N. E. Brown. (*G. C.* 1891, ix., p. 360.) S. A hybrid between *C. hirsutissimum* and *C. spicerianum*, raised by D. O. Drewett.

**Cypripedium corningianum**, Hort. (*G. M.* 1891, Aug., p. 495.) A hybrid between *C. superbiens* and *C. philippinense*, raised by J. Veitch & Sons.

**Cypripedium desboisianum**, Hort. (*L.* vol. 6, p. 77, pl. 277; *W. G.* 1891, p. 275.) S. A garden hybrid between *C. venustum* and *C. Boxallii*, var. *atratum*. (L'Horticulture Internationale.)

**Cypripedium Engelhardtæ**, L. Lind. (*L.* vol. 6, p. 81, and p. 93, pl. 285.) S. A garden hybrid between *C. insigne*, var. *Maulei*, and *C. spicerianum*. (L'Horticulture Internationale.)

**Cypripedium Godefroyi**, var. **luteum**, O'Brien. (*G. C.* 1891, x., p. 393; *Gfl.* 1891, p. 642.) S. Differs from the type in the ground colour of the flowers being yellow instead of white, and the spots pale rosy-lilac. (H. Low & Co.)

**Cypripedium insigne**, var. **longisepalum**, Rolfe. (*G. C.* 1891, ix., p. 72.) S. Differs from the type in having a narrow dorsal sepal 2½ in. long and in having no spots. (F. Sander & Co.)

**Cypripedium javanico-spicerianum**, God. Leb. (*O.* 1891, p. 287.) S. A garden hybrid between *C. javanicum* and *C. spicerianum*.

**Cypripedium Juno**, N. E. Brown. (*G. C.* 1891, ix., p. 360.) S. A hybrid between *C. callosum* and *C. fairieanum*, raised by D. O. Drewett.

**Cypripedium macrochilum**, O'Brien. (*G. C.* 1891, x., p. 343, fig. 40.) S. A hybrid between *C. longifolium* and *C. Lindeni*, raised by Veitch & Sons.

**Cypripedium Macfarlanei**, Kränzlin. (*G. C.* 1891, x., p. 300; *Gfl.* 1891, p. 534.) S. A hybrid between *C. calophyllum* and *C. spicerianum*, raised by F. Sander & Co.

**Cypripedium Niobe**, var. **superbum**, Hort. (*G. C.* 1891, x., p. 591.) S. A superior variety of the hybrid raised from *C. spicerianum* and *C. fairieanum* by J. Veitch & Sons.

**Cypripedium Orpheus**, Rolfe. (*G. C.* 1891, ix., p. 39.) S. A hybrid between *C. venustum* and *C. callosum*, raised by Sander & Co.

**Cypripedium Pallas**, N. E. Brown. (*G. C.* 1891, ix., p. 360.) S. A hybrid between *C. callosum* and *C. calophyllum*, raised by D. O. Drewett.

**Cyrtanthus parviflorus**, Baker. (*G. C.* 1891, ix., p. 104.) Amaryllidaceæ. S. Allied to *C. angustifolius*. Flowers bright scarlet, produced along with the linear leaves in January. (D. Paul, Norwich.)

**Dabœcia cantabrica**, Huds. var. **calyculata**, Dieck. (*Nat. Arb. Zösch.* 1891, p. 14; *G. C.* 1891, vol. 9, p. 461.) Ericaceæ. H. shr. producing both red and white fl. A form in which the calyx is developed so as to give it the appearance of having double flowers. Garden variety.

**Daphne glomerata**, Lam. (*Nat Arb. Zösch.* 1891, p. 14.) Thymeleaceæ. H. A dwarf shr., something in the way of *D. blagayana*, with naked stems crowned by a rosette of oblanceolate obtuse l., among which are clustered the umbels of lilac-purple fl. Caucasus, Armenia. (Dieck.)

**Dendrobium dalhousieanum**, var. **luteum**, J. O'Brien. (*G. C.* 1891, ix., p. 728.) Orchideæ. S. A straw-yellow flowered form. India. (General E. S. Berkeley.)

**Dendrobium niveum**, Rolfe. (*G. C.* 1891, ix., p. 104.) S. A new name proposed for the species described by Reichenbach in 1882 as *D. Macfarlanei*, the latter name having previously been given to a Dendrobium from New Guinea by F. Mueller.

**Dendrobium leeanum**, Hort. (*G. C.* 1891, x., p. 591, 640.) S. A new species with tall slightly compressed pseudobulbs, not unlike *D. superbiens* in habit and form of flowers, which are white, mottled with rose, tinged with green at the base of the lip. New Guinea. (F. Sander & Co.)

***Dipladenia illustris**, A. DC. var. **glabra**, Muell. (*B. M.* t. 7156; *Gfl.* 1891, p. 333; *Bull. Cat.* 1891, p. 4.) Apocynaceæ. A handsome stove climber with a woody rootstock, annual climbing stems, leathery ovate leaves, and large rosy-red flowers. Brazil. (Kew.)

***Disa Veitchii**, Hort. (*G. and F.* 1891, iv., p. 305; *G. C.* 1891, ix., p. 741.)

Orchideæ. G. A hybrid between *D. grandiflora* and *D. racemosa*, raised by J. Veitch & Sons.

*__Dissotis incana__, Triana. (*G. C.* 1891, ix., p. 204, fig. 46.) Melastomaceæ. G. or S. This plant was in cultivation 50 years ago when it was figured in *B. M.* t. 3790. It has been reintroduced from Natal where it is known as *Osbeckia umlaasiana*. Greenhouse. (Kew.)

**Dolichandra cynanchoides**, Seem. (*B. T. O.* 1891, p. 112, t. 4; *W. G.* 1891, p. 282.) Bignoniaceæ. G. An ornamental climber with opposite l., each with two oblong leaflets and often ending in a tendril. Peduncles axillary with 1–3 long-tubed red fl. Argentine.

**Dryas lanata**, Stein. (*G. C.* 1891, vol. ix., p. 340.) Rosaceæ. H. A Tyrolese form of *D. octopetala* with woolly leaves. July. Tyrol. (H. Correvon.)

*__Drymophlœus appendiculata__, Scheff. (*B. M.* 7202.) Palmæ. S. A dwarf palm with large cuneate leaf segments and lateral flower-scapes. It matures fruit annually under cultivation at Kew. Syn. *D. olivæformis*, *G. and F.* 1891, p. 330, f. 57; *W. G.* 1891, p. 392.

**Elæodendron sphœrophyllum**, var. **pubescens**, N. E. Brown. (*G. C.* 1891, ix., p. 393.) Celastraceæ. G. and H. H. A branching leafy evergreen shrub from South Africa, cultivated in some parts of Italy as *Guevina avellana*.

**Epidendrum dellense**, O'Brien. (*G. C.* 1891, ix., p. 584; *Gfl.* 1891, p. 360.) Orchideæ. S. A hybrid between *E. xanthinum* and *E. radicans*, raised by Baron Schroder.

**Epidendrum mooreanum**, Rolfe. (*Kew Bull.* 1891, p. 199.) S. Allied to *E. stellata*, with linear l. 1 ft. long, and a lax panicle of moderate-sized, green and purple, fragrant fl. Costa Rica. (Glasnevin Botanic Garden; W. Bull.)

**Epidendrum pusillum**, Rolfe. (*G. C.* 1891, x., p. 669.) S. A small species allied to *E. lampense*, Ldl.; pseudobulbs ovoid-globose, leaves 5 in. long, raceme one-flowered, flower yellowish-green freckled with brown. Brazil.

*__Epiphyllum Gærtneri__, Hook. f. (*B. M.* t. 7201; *G. and F.* iv., p. 210.) Cactaceæ. G. A third species of this genus, previously considered to be only a variety of *E. russellianum*. Syn. *E. makoyanum*, Hort. (Kew.)

**Erysimum Wahlenbergii**, Simonkai (*G. C.* 1891, vol. x., p. 190.) Cruciferæ. H. A showy perennial species. Stem 2 ft. high, branched, l. lanceolate, toothed, fl. bright yellow. July. Transylvania. (Kew.)

*__Eucryphia Billiardieri__, Spach, var. **Milligani**, Hook. f. (*B. M.* t. 7200; *Gfl.* 1891, p. 611.) Rosaceæ. A handsome white-flowered evergreen tree or shrub. Tasmania. (Kew.)

**Eulophia nuda**, Ldl. (*G. C.* 1891, ix., p. 701.) Orchideæ. S. Raceme erect, preceding the leaves, flowers medium-sized, rosy-lilac. India. (Sir T. Lawrence.)

*__Forsythia intermedia__, Zabel. (*Gfl.* 1891, p. 395, and 397, f. 82, 1 4.) Oleaceæ. H. shr. A garden hybrid between *F. suspensa* and *F. viridissima*.

*__Galanthus Alleni__, Baker. (*G. C.* 1891, vol. ix., p. 298; *Gfl.* 1891, p. 246.) Amaryllideæ. H. A beautiful new species mid-way between *G. latifolius* and *G. caucasicus*, l. short, broad, glaucous fl. white. March. Caucasus. (Allen; Kew.)

**Galanthus nivalis**, var. **Atkinsi**, Hort (*Gfl.* 1891, p. 246.) H. A garden variety with large fl.

**Galanthus nivalis**, var. **Elsæ**, Burbidge. (*Gard.* 1891, vol. 39, p. 243.) Amaryllideæ. H. Nearly allied to *G. corcyrensis*, but having larger flowers, and stouter leaves. November to January. Mount Athos, Macedonia. (Burbidge.)

**Galanthus nivalis**, var. **Racheliæ**, Burbidge. (*Gard.* 1891, vol. 39, p. 243.) Amaryllideæ, H. Allied to var. *Elsæ*, more robust and with larger flowers. October and November. Mount Hymettus. (Burbidge.)

**Gomphocarpus sinaicus**, Hochst. (*W. G.* 1891, 448, f. 85.) Asclepiadaceæ. G. or H. H. This is a synonym of the common *G. fruticosus*. Syria to S. Africa. (Dammann & Co.)

*__Habenaria carnea__, N. E. Brown. (*G. and F.* 1891, iv., p. 475, f. 76; *G. C.* 1891, x., p. 729, fig. 105.) Orchideæ. S. A new species with ovate leaves spotted with grey, and an erect scape bearing three to five flowers of an uniform pale pink colour. Singapore. (Kew.)

**Hæmaria Otletæ**, Rolfe. (*Ill. H.* vol. 38, p. 31, pl. 124.) Orchideæ. S. A beautiful Anæctochilus-like plant 6–10 in. high, with lanceolate acute l., of a dark olive-green veined with coppery. The

fl. are arranged in a lax spike, white with a yellow-tinted one-sided lip. Tonkin. (L'Horticulture Internationale.)

**Helenium Bolanderi**, A. Gr. (*R. H.* 1891, p. 377, f. 93–94.) Compositæ. H. per. of vigorous habit and very free flowering, 1½–2 ft. high, with lanceolate acute l. and solitary heads of fl. about 2 inches in diam., the ray bright yellow, the disk dark brown. N. America.

***Hermannia cristata**, Bolus. (*B. M.* t. 7173.) Sterculiaceæ. G. shr. A dwarf plant with a woody rootstock, thin wiry stems, lanceolate toothed leaves and drooping axillary flowers ¾ in. long, coloured orange-red. Transvaal. (Kew.)

**Hibiscus californicus**, Kellogg. (*W. G.* 1891, p. 484.) Malvaceæ. H. shr. 5–6 ft. high, something in the way of *H. palustris* with large white fl. 5–5½ in. in diam., purple in the centre. California. (Lemoine.)

***Hibiscus calycinus**, Willd. (*G. C.* 1891, x., p. 462.) S. shr. The correct name of the plant introduced and distributed a few years ago under the name of *H. chrysanthus*. Native of Natal.

***Hibiscus surattensis**, Linn. (*G. C.* 1891, ix., p. 529, fig. 105.) S. A scandent species, with palmately lobed leaves, and cupped flowers, 2 in. across, yellow with a crimson eye. The curiously formed involucre gives this species a special interest. Tropics. (Kew.)

**Hibiscus venustus**, Blume. (*B. M.* t. 7183; *Gfl.* 1891, p. 440.) S. A handsome tall shrub, with obed orbicular leaves 18 in. diam., and creamy-yellow flowers 3 in. across. Its nearest ally is *H. mutabilis*. Tahiti? (A. Kingsmill, Harrow.)

**Hypericum Buckleyi**, M. A. Curtis. (*G. and F.* vol. iv., p. 581, fig. 91.) Hypericineæ. A dwarf shrubby species with solitary, terminal, bright yellow flowers, one inch across. North Carolina. (Arnold Arboretum.)

**Ilex monticola**, A. Gr. (*Nat. Arb. Zösch.* 1891, p. 15.) Ilicineæ. H. shr., with elliptic acuminate l., acute at the base, finely serrate, and rather thin in texture; berries solitary, axillary red. Eastern United States. (Dieck.)

***Impatiens mirabilis**, Hook. f. (*B. M.* t. 7195.) Geraniaceæ. S. A new species with an erect naked trunk that attains 4 ft. in height and the thickness of a man's leg. Leaves nearly a foot long, fleshy, green; flowers curiously inflated, golden yellow. Langkawi Island. (Kew; J. Veitch & Sons.)

**Ipomœa camerunensis**, Taub. (*Gfl.* 1891, p. 393, t. 1352.) S. climber. This is merely an entire leaved form of **I. paniculata**. Cameroons. (Berlin Botanic Garden.)

**Iris argentea**, André. (*R. H.* 1891, p. 36, with plate.) Iridaceæ. H. per. A variety of *I. xiphioides*, with white falls blotched with purple. Garden variety. (Thiebaut, Paris.)

***Iris fosteriana**, Baker. (*B. M.* t. 7215; *G. C.* 1891, vol. ix., p. 496.) H. A very fine Iris of the *Caucasica* set. Sep. and standards primrose-yellow, limb spoon-shaped, deep violet. (Michael Foster, Kew.)

***Iris robinsoniana**, F. Müll. (*Gard.* 1891. pl. 825; *G. C.* 1891, ix., p. 457; *G. and F.* 1891, iv., p. 352, f. 60.) G. The gigantic Iris from Lord Howe's Island. It has been in cultivation for some years, but flowered for the first time at Kew this year. This plant is also named **Moræa robinsoniana.** (Moore & Muell.)

**Jasminum polyanthum**, Franchet. (*R. H.* 1891, p. 270; *W. G.* 1891, p. 403; *B. T. O.* 1891, p. 289.) Oleaceæ. G. shr. A free flowering species with pinnate l., and panicles of long-tubed fl., pink outside, white within. Yunnan, China.

**Kirengeshoma palmata**, Yatabe. (*G. C.* 1891, ix., p. 202; *W. G.* 1891, p. 159.) A new genus of Saxifrageæ, allied to Hydrangea.

**Kniphofia.** (*B. T. O.* 1891, p. 81.) Liliaceæ. H. per. At the above place a large number of garden hybrids derived from *K. uvaria*, *K. Macowani*, *K. Rooperi*, and *K. Burchellii*. are briefly described. (Dammann & Co.)

**Lachenalia Comesii**, Sprenger. (*Gfl.* 1891, p. 358, f. 77.) Liliaceæ. G. bulb. A garden hybrid between *E. reflexa* and *L. quadricolor*.

**Lachenalia regeliana**, Sprenger. (*Gfl.* 1891, p. 356, f. 76.) G. bulb. A garden hybrid between *L. reflexa* and *L. aurea*.

**Lælia anceps**, var. **holocheila**, Rolfe. (*G. C.* 1891, ix., p. 426; *G. and F.* iv., p. 173, fig. 31.) Orchideæ. S. Differs from the type in having an entire narrow labellum. (The Liverpool Hort. Co.)

**Lælia arnoldiana**, Hort. Sand. (*G. C.* 1891, vol. 9, p. 740; *J. of H.* 1891, p. 491, f. 93; *G. and F.* 191, vol. 4, p. 305.) S. A garden hybrid between *L. purpurata* and *Cattleya labiata*. Syn. *Lælio-cattleya arnoldiana*. (Rolfe.)

**Lælia crispa,** Rchb. f. var. **Cauwelaertiæ,** Lind. (*Ill. H.* vol. 38, p. 19, l. 121.) S. A variety with the basal half of the lip of a greenish-yellow colour. Brazil. (Dr. van Cauwelaert.)

**Lælia gottoiana,** Hort. (*G. M.* 1891, June, p. 379.) S. A variety or natural hybrid imported along with *L. grandis*. Flowers 7 in. across, rose coloured, lip purple, lined with maroon. (E. Gotto, Hampstead.)

**Lælia grandis,** Lindl. var. **tenebrosa,** God. Leb. (*O.* 1891, p. 161; *G. C.* 1891, vol. 10, p. 126; *R.* 2nd ser., p. 69, t. 33; *L.* vol. 7, p. 7, pl. 290; *Gfl.* 1891, p.495.) S. A handsome form with coppery bronze sep. and pet., and a trumpet-shaped lip of a rich purple bordered with white. Sierra da Itaraca, Brazil. (Binot; L'Horticulture Internationale, etc.)

**Læliocattleya arnoldiana,** Rolfe. (*L.* v. 7, p. 25, pl. 299.) Orchideæ. S. This is the same as *Lælia arnoldiana*.

**Ligustrum medium,** Fr. and Sav. (*Nat. Arb Zösch.* 1891, p. 15.) Oleaceæ. H. shr. or small tree with broadly lanceolate acute l. and terminal panicles of small white fl. Japan. (Dieck.)

**Lilium Elisabethæ,** Leichtlin. (*W. G.* 1891, p. 198.) Liliaceæ. This is the same as *L. japonicum*, Thunb., (*L. Krameri*, Hk. f.) Japan. (Vilmorin; Leichtlin.)

***Lilium longiflorum,** var. **chloraster,** Baker. (*G. C.* 1891, vol. x., pp. 66 and 225.) H. A well marked variety of *L. longiflorum*, fl. resembling those of *L. Browni*, pollen red-brown. Central China. July. (Kew.)

**Lilium Lowii,** Baker. (*G. and F.* 1891, iv., p. 352.) S. A new species closely related to *L. nepalense*, but having smaller leaves and white flowers with a few purple blotches. N. India. (H. Low & Co.)

***Lilium Martagon × Hansoni,** Baker. (*G. C.* 1891, x., p. 94.) H. A hybrid between the two species named, raised by C. G. van Tubergen, Haarlem.

**Livistona enervis,** Hort. (*W. G.* 1891, p. 346.) Palmæ. S. An ornamental Palm with deeply divided fan-shaped l., the segments of which are only half an inch broad, and very delicate in texture. ? *L. inermis*, R. Br.

**Lonicera tangutica,** Maxim. (*Gfl.* 1891, p. 580.) Caprifoliaceæ. H. shr. with oblong or obovate-oblong l., glaucous beneath, and pairs of small yellowish fl. on long slender peduncles, succeeded by globose red berries. Kansu. (St. Petersburg Forest Institute.)

**Lonicera tatarica,** L. var. **grandibracteata,** Wolf. (*Gfl.* 1891, p. 486, f. 90.) H. shr. A seedling variety with large leafy bracts. (St. Petersburg Forest Institute.)

**Lycaste Skinneri,** Ldl. var. **armeniaca,** Sand. (*R.* 2nd ser., v. 1, p. 39, t. 18.) Orchideæ. S. A beautiful variety with an apricot-yellow lip. (Sander & Co.)

**Lysimachia paridiformis,** Franch. (*G. C.* 1891, vol. x., p. 190; *W. G.* 1891, p. 398; *Gfl.* 1891, p. 495.) Primulaceæ. H. A most remarkable species resembling *Paris quadrifolia*, l. oval, tapering to both ends, fl. axillary bright yellow. Central China. July. (Kew.)

***Magnolia Watsoni,** Hook. f. (*B. M.* 7157; *G. C.* 1891, vol. 10, p. 34; *G. and F.* vol. 4, p. 112.) Magnoliaceæ. A deciduous species with large creamy-white flowers with blood-red filaments. This plant is grown in some gardens under name of *M. parviflora*. Japan. (Kew; J. Veitch & Sons.)

**Malus dasyphylla,** Borkh. var. **armeniæfolia,** Doehn. (*G. C.* 1891, vol. 9, p. 461; *Nat. Arb. Zösch.* 1891, p. 16.) Rosaceæ. H. tree. "A form "of the wild apple from the Levant, "with tomentose leaves, which are "much more like those of a plum than "those of an apricot, though the name "points to the latter." (Zöschen Arboretum.)

**Malus medwietzkyana,** Dieck. (*G. C.* 1891, vol. 9, p. 461; *Nat. Arb. Zösch.* 1891, p. 16; *W. G.* 1891, p. 164.) H. tree. "Except the old leaves, all parts "of the tree are red, bark and wood, as "well as flowers and fruits, which "resemble small Sina-apples; even the "pulp, which has a fine flavour, is of a "dark rosy colour." Siberia, &c. (Zöschen Arboretum.)

***Malus Parkmanni flore pleno,** Hort. (*G. C.* 1891, vol. 9, p. 461.) A synonym of **Pyrus Parkmanni.** "This "beautiful tree or large shrub was "obtained under this name from "America. It shows relationships to "*M. spectabilis* and *floribunda*; it is, "perhaps, a hybrid between these two "species."

***Maranta arundinacea,** var. **variegata,** Ridley. (*G. C.* 1891, ix., p. 73.) Scitamineæ. S. This is the correct name of the plant cultivated in gardens under the name of *Phrynium variegatum*. Origin unknown.

***Mariscus umbilensis,** C. B. Clarke. (*G. C.* 1891, x., p. 190.) Cyperaceæ. S. The correct name of the plant cultivated in England as *Cyperus natalensis*.

**Masdevallia falcata,** O'Brien. (*G. C.* 1891, ix., p. 552.) Orchideæ. S. A hybrid between *M. Lindeni* and *M. Veitchii*, raised by D. O. Drewett.

**Masdevallia harryana,** Rchb. f. var. **splendens,** Sand. (*R.* 2nd ser., v. 1, p. 55, t. 26.) S. A form with very large and dark magenta-purple fl. (Glasnevin Botanic Garden.)

**Masdevallia mundyana,** Hort. (*G. and F.* 1891, iv., p. 293.) S. A hybrid between *M. Veitchii* and *M. ignea*, var. *aurantiaca*, raised by F. Sander & Co.

**Megaclinium Clarkei,** Rolfe. (*Kew Bull.* 1891, p. 198.) Orchideæ. S. Bulbs an inch long, bearing two oblong obtuse l., and a flattened fl.-spike, fl. small, green and purple. West tropical Africa. (Col. Trevor Clarke.)

**Megaclinium leucorhachis,** Rolfe. (*Kew Bull.* 1891, p. 198.) S. Bulbs with one linear-oblong obtuse l., fl.-spike flat, nearly white with deep yellow fl. Tropical Africa? (Sir Trevor Lawrence.)

**Melampodium ovatifolium,** Rchb. (*B. T. O.* 1891, p. 111.) Compositæ. H. annual. This is a synonym of *M. divaricatum*, DC.

**Miltonia Regnellii,** Rchb. f. var. **purpurea,** Pynaert. (*R. H. B.* 1891, p. 253, with pl.) Orchideæ. S. A fine variety with bright purple fl. marked with darker veins on the lip. Brazil. (Pynaert.)

**Miltonia vexillaria,** Rchb. f. var. **sanderiana,** O'Brien. (*G. C.* 1891, vol. 10, p. 394; *G. and F.* vol. 4, p. 545.) S. This is a synonym of the variety **Leopoldii**, see *Kew Bulletin*, 1890, *Appendix* II.; and *R. H. B.*, 1891, p. 73, with pl. (Sander & Co.)

**Mormodes lawrenceanum,** Rolfe. (*L.* vol. 6, p. 69, pl. 273.) Orchideæ. S. Allied to *M. Cartoni*, having long racemes of good-sized yellowish fl. The lip dotted with brown. Columbia. (L'Horticulture Internationale.)

**Mormodes punctatum,** Rolfe. (*G. C.* 1891, x., p. 696.) S. A new species allied to *M. Wendlandii*, Rchb. f. Pseudobulbs 3½ in. long, leaf 10 in. long; raceme erect bearing several flowers, coloured yellowish-brown spotted with chestnut. (M. Gustave Bral, Ghent.)

**Mormodes rolfeanum,** L. Lind. (*L.* v. 7, p. 5, pl. 289.) S. This has a lax raceme of large fl. green tinted with brown and marked with dark green nerves; lip brownish-crimson above, yellowish-green beneath. Peru. (L'Horticulture Internationale.)

***Musa Basjoo,** Sieb. and Zucc. (*B. M.* 7182; *Gfl.* 1891, p. 439; *W. G.* 1891, p. 445.) Scitamineæ. S. This is the correct name for the plant introduced from Japan by J. Veitch & Sons, and distributed by them as *M. japonica*.

**Mutisia viciæfolia,** Carr. (*R. H.* 1891, p. 228, with pl.; *W. G.* 1891, p. 283.) Compositæ. G. or H. H. climber of great beauty, with pinnate l. like those of a Vetch, and large radiate heads of bright orange fl. Peru, Bolivia, Chili. (Constant, Golfe Juan; Thuret, Antibes.)

**Napoleona Miersii,** Hook. f. (*B. M.* t. 7199.) Myrtaceæ. S. shr. This name has been given to the plant hitherto cultivated under the erroneous name of *N. Whitfieldii*.

**Narcissus Fenzii,** Sprenger. (*Gfl.* 1891, p. 428, f. 84; *B. T. O.* 1891, p. 100.) Amaryllidaceæ. H. bulb. A garden hybrid between *N. pseudonarcissus* and *N. cypri*. (Dammann & Co.)

**Narcissus Margaritæ,** Sprenger. (*Gfl.* 1891, p. 491, f. 91.) H. bulb. A garden hybrid between *N. pseudonarcissus* and *N. papyraceus*.

**Narcissus Victoriæ,** Sprenger. (*Gfl.* 1891, p. 453, f. 86.) H. bulb. A garden hybrid between *N. pseudonarcissus* and *N. aureus*.

***Neobenthamia gracilis,** Rolfe. (*G. C.* 1891, x., p. 272, fig. 33; *Gfl.* 1891, p. 534.) Orchideæ. S. A new genus of the tribe Vandeæ, allied to *Bromheadia*. It has long thin bamboo-like stems, narrow leaves and terminal many-flowered racemes. The flowers are nearly an inch across and pure white. Zanzibar. (Kew.)

**Nerine pancratioides**, Baker. (*G. C.* 1891, x., p. 576.) Amaryllidaceæ. G. bulb. A new species with long narrow leaves subterete in the lower half. Scape 2 ft. high. Umbel 12 to 20 flowered, perianth white, 1 in. long with small square bifid scales between each of the filaments as in *Pancratium*. Natal. (J. O'Brien.)

**Odontoglossum andersonianum**, var. **imperiale**, O'Brien. (*G. C.* 1891, ix., p. 330.) Orchideæ. S. A variety with large flowers, the segments broad, with large blotches of chestnut-red on a straw-yellow ground. (W. J. Thomson, St. Helens.)

**Odontoglossum Bergmanni**, L. Lind. (*L.* vol. 6, p. 95, pl. 286.) S. A form of *O. crispum* which appears to be the same as var. *Stevensii*. The fl. are white with large brown blotches. (Bergman.)

**Odontoglossum clæsianum**, L. Lind. (*L.* vol. 6, p. 65, pl. 271.) A supposed hybrid between *O. crispum* and *O. luteopur-pureum* or *O. odoratum*. Fl. white, blotched with brownish-crimson. Columbia. (L'Horticulture Internationale.)

**Odontoglossum cookianum**, Rolfe. (*G. C.* 1891, x., p. 696.) S. A supposed natural hybrid between *O. triumphans* and *O. sanderianum*. It has deep yellow sepals and petals with numerous chestnut blotches, the lip being exactly like that of *O. sanderianum*. (M. C. Cook, Kingston Hill.)

**Odontoglossum crispum**, Lindl. var. **bluthiana**, Damm. (*Gfl*, 1891, p. 482, t. 1356.) S. A delicate form with pale mauve sep. and pet. without spots. (F. Bluth, Steglitz.)

**Odontoglossum dellense**, O'Brien. (*G. C.* 1891, ix., p. 521.) S. Supposed to be a natural hybrid between *O. Pescatorei* and *O. prænitens*. (Baron Schroder.)

**Odontoglossum godseffianum**, Rolfe. (*G. C.* 1891, x., p. 728.) S. A supposed natural hybrid between *O. triumphans* and *O. lindleyanum*. It might be described as *O. triumphans* with acuminate segments, and the lip of *O. coradinei*. (Sander & Co.)

**Odontoglossum Hennisii**, Rolfe. (*G. C.* 1891, x., p. 158; *Gfl.* 1891, p. 495.) S. A new species resembling *O. odoratum*, Ldl. Sepals and petals yellow with brown spots, lip white and brown. Peru or Ecuador. (Shuttleworth, Charlesworth & Co.)

**Odontoglossum imschootianum**, Rolfe. (*G. C.* 1891, x., p. 758.) S. Supposed to be a natural hybrid between *O. tripudians* and *O. lindleyanum*. It is very similar to the latter. (Imschoot, Ghent.)

**Odontoglossum leroyanum**, God. Leb. (*O.* 1891, p. 112, with pl.) S. A garden hybrid between *O. crispum* and *O. luteopurpureum*. (Leroy, Armainvilliers.)

**Odontoglossum luteopurpureum**, var. **amesianum**, Hort. (*G. C.* 1891, ix., p. 344.) S. "Flowers of a pale yellow-green colour." (Sander & Co.)

**Odontoglossum ornatum**, Hort. (*W. G.* 1891, p. 341.) S. A beautiful form with regular fl. creamy-white in the centre, and marked with small red spots. Columbia. (Vuylsteeke, Loochristy-les-Gand.)

**Odontoglossum ortgiesianum**, Sand. (*Gfl.* 1891, p. 617, t. 1360.) S. A supposed natural hybrid between *O. crispum* and *O. odoratum*. The fl. are white, edged with yellow, spotted with deep red. Columbia. (Ortgies.)

**Odontoglossum picturatum**, Hort. (*W. G.* 1891, p. 341.) S. The fl. are similar to those of the section to which *O. gloriosum* belongs; they are of a fine yellow speckled with brown. (Vuylsteeke, Loochristy-les-Gand.)

**Odontoglossum Rossii**, Lind. var. **albens**, Will. (*Williams O. A.* vol. 10, pl. 434.) S. A form spotted with yellow, instead of brown. Mexico. (R. Young, Linnet Lane, Liverpool.)

**Odontoglossum Seringa**, Hort. (*W. G.* 1891, p. 341.) S. A form with very round fl., somewhat smaller than that of *O. Alexandræ*, the centre of the fl. is white, the sep. and pet. are bordered with yellow, and the entire fl. is spotted with irregular patches of brown-red. Seringa, Columbia. (Vuylsteeke, Loochristy-les-Gand.)

**Odontoglossum, wilckeanum**, Rchb. f. var. **atropurpureum**, Hort. (*W. G.* 1891, p. 341.) S. A variety with an edging of yellow to the red sep. and pet. Columbia. Syn. *O. Zaldua* and *O. President Zaldua*. (Vuylsteeke, Loochristy-les-Gand.)

**Odontoglossum wilckeanum**, Rchb. f. var. **rothschildianum**, Sand. (*R.* 2nd ser., v. 1, p. 47, t. 22; *Gfl.* 1891, p. 495.) S. A form with large yellow fl. blotched with dark red-brown. Bogota. (Sander & Co.)

**Oncidium Forbesii,** var. **measuresianum,** Kränzlin. (*G. C.* 1891, x., p. 227.) S. A variety with pure golden-yellow flowers with a very narrow border of purplish-brown. (R. H. Measures, Streatham.)

**Oncidium larkinianum,** Hort. (*G. C.* 1891, ix., p. 532.) S. Supposed to be a natural hybrid between *O. curtum* and *O. barclayanum.* (J. Larkin, Watford.)

**Oncidium leopoldianum,** Rolfe. (*L.* vol. 6, p. 71, pl. 274.) S. A new species with a long panicle bearing as many as 300 fl. white, with the central area of the sep. and pet.; and the front lobe of the lip mauve-purple, the base of the lip being yellow. (L'Horticulture Internationale.)

***Oncidium urophyllum,** Ldl. (*G. C.* 1891, ix., p. 701.) S. Figured by Lindley in 1841 from a plant in the Loddiges collection, said to have been imported from Brazil. It has recently been reintroduced to Kew from the island of Antigua. It has a drooping panicle 4 ft. long of clear yellow flowers with a few brown markings.

***Ornithogalum Saundersiæ,** Baker. (*G. C.* 1891, x., p. 452.) Liliaceæ. G. bulb. A new species allied to *O. arabicum,* L. Scape 3 ft. high bearing an umbel of about 20 flowers, 1 in. across, white, tinged outside with green. Transvaal. (Kew.)

**Orphanidesia gaultherioides,** Boiss. (*Nat. Arb. Zösch.* 1891, p. 17; *Gfl.* 1891, p. 469, f. 87.) Ericaceæ. H. A dwarf shrubby plant, with prostrate leafy branches, covered with stiff hairs and glands. L. oblong acute, rough beneath. Peduncles 1–2 flowered; the calyx-lobes are large and the corolla hypocrateriform, colour not stated. Caucasus. (Dieck.)

**Pachyrhizus thunbergianus,** S. and Z. (*G. C.* 1891, ix., p. 247.) *See* **Pueraria thunbergiana.**

**Papaver glaucum,** Boiss. and Haussk. (*Gfl.* 1891, p. 608, f. 116–117.) Papaveraceæ. H. annual. A very distinct species with pinnatifid glaucous l. and solitary fl. 3–4 in. in diam. of a deep scarlet-red colour, and remarkable in having the petals arranged in the form of a double cup. Armenia. (Max Leichtlin; Ernst Benary, Erfurt.)

***Pelexia olivacea,** Rolfe. (*Kew Bull.* 1891, p. 200.) Orchideæ. S. An unattractive species with dull olive-green l. marked with two silvery bands. Scape and fl. pubescent; sep. olive-green; pet. and lip white. Andes. (Kew.)

**Pennisetum triflorum,** Nees. (*Jard.* 1891, p. 213.) Gramineæ. An ornamental grass with elegant, tail-like, white or purple fl.-spikes growing to a foot in length. India. (Vilmorin.)

**Pennisetum villosum,** R. Br. (*Jard.* 1891, p. 213, with fig.) S. per., or may be treated as a H. H. annual. An ornamental grass of tufted habit with long, dense, plumose, white spikes. Abyssinia. (Vilmorin.)

**Peristeria aspersa,** Rolfe. (*L.* vol. 6, p. 57, pl. 267.) Orchideæ. S. An interesting species in the way of *P. Rossii,* having a short raceme with about 10 large yellow-brown fl. covered with brownish-red dots, and the front of the lip dark crimson. Venezuela. (L'Horticulture Internationale.)

**Phaius maculato-grandifolius,** Hort. (*G. C.* 1891, x., p. 591.) Orchideæ. S. A hybrid between the two species indicated by the specific name, raised by J. Veitch & Sons.

**Pholidota repens,** Rolfe. (*Kew Bull.* 1891, p. 199.) Orchideæ S. Rhizome creeping, jointed; l. 3–4 in. long, oblanceolate; racemes short, recurved; fl. small, flesh-pink. India. (O'Brien.)

**Phyllocactus albus superbissimus,** Haage & Schmidt. (*Gfl.* 1891, p. 258.) Cactaceæ. G. A garden seedling with large yellowish-white fl. (Haage & Schmidt.)

**Physosiphon guatemalensis,** Rolfe. (*Kew Bull.* 1891, p. 197.) Orchideæ. S. A small species allied to *P. Loddigesii,* with oblong l. and a raceme of small yellow and purple fl., Guatemala. (Glasnevin Botanic Garden.)

**Picea orientalis,** var. **nana,** Carr. (*R. H.* 1891, p. 120.) Coniferæ. H. shr. A form of pyramidal habit depressed and enlarged at the base. Garden variety. (Croux et fils.)

***Pinguicula lutea,** Nuttall. (*G. C.* 1891, ix., p. 729; *B. M.* t. 7203.) Lentibulariaceæ. G. First introduced in 1816, but long since lost until it reappeared at Kew recently. It is similar to *P. vulgaris,* but has sulphur-yellow flowers, the segments nearly regular. S. United States.

**Pinus patula,** Scheide and Deppe, var. **macrocarpa,** Schiede. (*G. C.* 1891, vol. ix., p. 435, fig. 92.) Coniferæ. H. A form with cones much larger

than those of the type. "Pinus del Doctor." Mexico. (Fratelli Rovelli.)

**Polystachya bulbophylloides**, Rolfe. (*Kew Bull.* 1891, p. 199.) Orchideæ. S. A minute species with the habit of a small Bulbophyllum, and subsessile white fl. with an orange spot on the lip. West Coast of Africa. (O'Brien.)

*__Primula Forbesii__, Franchet. (*Gard.* 1891, vol. 40, p. 556.) Primulaceæ. H.? A new Primrose, midway between *P. cortusoides*, which it resembles in the leaves, and *P. farinosa* in the flowers; it bears however three to six whorls, pale lilac. November. Yunnan, China. (Vilmorin.)

*__Primula imperialis__, Jungh. (*G. C.* 1891, ix., p. 729; *G. M.* 1891, Dec., p. 758, fig.; *J. of H.* 1891, xxiii., fig. 1; *Gard.* 1891, pl. 823.) G. The true Java plant which differs specifically from the Himalayan Primrose figured in Bot. Mag. t. 6732 under *P. prolifera*. The leaves of the former are 15 in. long and 5 in. wide; the scape erect, 3–4 ft. high, the flowers in four to six whorls, rich cowslip-yellow, tinged with orange. This plant is probably hardy in England. (Kew.)

**Pteris cretica**, var. **crispata**, Veitch. (*Veitch Cat.* 1891, p. 11.) Filices. G. Fern. An ornamental variety of dwarf compact habit, with broad pinnules crisped and wavy along the margins and marked by a medium white band. Garden variety. (J. Veitch & Sons.)

*__Pueraria thunbergiana__, Benth. (*R. H.* 1891, p. 31, f. 8; *W. G.* 1891, p. 24.) Leguminosæ. H. climber with trifoliolate l., and axillary racemes of bluish-violet fl. Japan. Syn. *Pachyrhizus thunbergianus*, S. and Z. *Dolichos hirsutus*, Thbg., and *D. japonicus* of gardens. Cultivated at Kew many years.

**Pyrus Parkmanni**, Hort. (*W. G.* 1891, p. 32.) *See* **Malus Parkmanni.**

*__Quercus pontica__, C. Koch. (*Nat. Arb. Zösch.* 1891, p. 18; *Gfl.* 1891, p. 509, f. 95; *G. C.* 1891, vol. 9, p. 462.) Cupuliferæ. H. tree with large elliptic coarsely-toothed l., growing to 6 in. in length by 3 in. in breadth, glaucous beneath, and small subglobose acorns, twice as long as their small scaly cup, Lazistan. (Dieck.)

**Renanthera imschootiana**, Rolfe. (*Kew Bull.* 1891, p. 200.) Orchideæ. S. A fine showy species allied to *R. coccinea*, with shorter perianth segments. The fl. are reddish and yellow. (Van Imschoot; Sander & Co.)

*__Restrepia striata__, Rolfe. (*G. C.* 1891, ix., p. 137.) Orchideæ. S. Differs from other species of the genus in having striped instead of spotted sepals. Otherwise it is not unlike *R. elegans*. New Granada. (Low & Co., and Glasnevin Botanic Garden.)

**Rhipsalis dissimilis**, K. Schum. (*Gfl.* 1891, p. 634, f. 121.) Cactaceæ. G. succulent. This is the plant described last year as *Lepismium dissimile*.

*__Rhododendron intermedium__, Tausch. (*Nat. Arb. Zösch.* 1891, p. 20.) Ericaceæ. H. shr. A hybrid between *R. ferrugineum* and *R. hirsutum*.

*__Rhododendron Smirnowi__, Max. (*G. C.* 1891, vol. 9, p. 462.) A hardy evergreen shrub with leaves white or rusty beneath; flowers crimson. Tschoruk. (St. Petersburg Botanic Garden.)

*__Rhododendron Ungerni__, Max. (*G. C.* 1891, vol. 9, p. 462.) An evergreen shrub with large leaves snowy white beneath. Flowers white. Tschoruk. (St. Petersburg Botanic Garden.)

*__Robinia neomexicana__, Hort. (*Gfl.* 1891, p. 362.) Leguminosæ. H. tree. Probably a form of *R. Pseudacacia*, with small glaucous l. and red fl.

**Rosa rugosa**, var. **calocarpa**, André. (*R. H.* 1891, p. 129, f. 35.) Rosaceæ. H. shr. A seedling variety with smaller leaves than the type, and large corymbs of depressed globose fr. of a bright red. Garden variety. (Bruant.)

*__Rosa wichuraiana__, Crép. (*G. and F.* 1891, vol. 4, p. 569, f. 89.) H. shr. A handsome species, with dark glossy green leaves and white flowers, suitable for clothing rocky slopes, &c. Japan.

*__Salix hoyeriana__, Dieck. (*Gfl.* 1891, p. 332.) Salicineæ. H. shrub of dwarf prostrate habit, with roundish-oval green l. 4 in. long by 2 in. broad. Cascade Mountains, British Columbia. (Zöschen Arboretum.)

**Salix purpurea**, L. var. **amplexicaulis**, Dieck. (*G. C.* 1891, vol. 9, p. 462.) A willow from the Galatian Pontus described as a distinct species (*S. amplexicaulis*) by Boissier. Galatian Pontus. (Zöschen Arboretum.)

**Sambucus racemosa**, L. var. **heterophylla**, Wolf. (*Gfl.* 1891, p. 656, f. 123.) Caprifoliaceæ. H. shr. A

garden variety having the l. simple or composed of three irregularly formed leaflets. (Imperial Forest Institute, St. Petersburg.)

**Sarracenia vittata maculata,** Williams. (*Williams' Cat.* 1891, p. 25.) Sarraceniaceæ. G. A garden hybrid between *S. purpurea* and *S. chelsoni.* (Williams & Son.)

**Scilla Adlami,** Baker. (*G. C.* 1891, ix., p. 521.) Liliaceæ. G. bulb. A small-flowered species after the style of *S. italica,* Linn. Flowers mauve-purple. Natal. (J. H. Tillett, Norwich.)

***Scilla laxiflora,** Baker. (*G. C.* 1891, ix., p. 668.) G. bulb. Allied to *S. revoluta,* Baker. Bulb globose, leaves lanceolate, scape 3 in. long, flowers green, filaments purple. S. Africa. (Kew.)

***Schomburgkia sanderiana,** Rolfe. (*G. C.* 1891, ix., 202.) Orchideæ. S. A new species allied to *S. Humboldtii.* It has hollow pseudobulbs, very rigid leaves, and a lax branched panicle of rosy-carmine medium-sized flowers. February. Habitat not stated. (Sander & Co.)

***Senecio Heritieri,** DC. (*G. and F.* 1891, iv., p. 510, f. 79.) Compositæ. G. The correct name for the plant cultivated as *Cineraria aurita.* Madeira.

**Sidalcea candida,** A. Gr. (*R. H.* 1891, p. 356, f. 85.) Malvaceæ. H. herbaceous per. 2–3 ft. high, with palmately divided l., and handsome terminal spikes of white fl. A very ornamental plant. Rocky Mountains.

**Sobralia macrantha,** var. **keinastiana,** Hort. (*G. and F.* 1891, iv., p. 305; *G.C.* 1891, ix., p. 741.) Orchideæ. S. A variety with large pure white flowers, save a blotch of yellow at the base of the labellum. (Baron Schröder.)

**Sorbus Aria,** var. **chrysophylla,** Hesse. (*W. G.* 1891, p. 128.) Rosaceæ. H. tree. A garden variety with yellow foliage. (Weener Baumschule.)

**Sorbus discolor,** Max. (*G. C.* 1891, vol. 9, p. 462.) H. A small tree allied to the White Beam, *Pyrus Aria.* East Siberia. (Zöschen Arboretum.)

***Spiræa Bumalda,** var. **ruberrima,** Hort. (*W.G.* 1891, p. 460; *Gard.* 1891, vol. 40, p. 415.) Rosaceæ. H. shr. A garden hybrid between *S. Bumalda* and *S. bullata* (*S. crispifolia*). (Lemoine.)

**Stanhopea graveolens,** Lindl. var. **Lietzei,** Rgl. (*Gfl.* 1891, p. 201, t. 1345.) Orchideæ. S. A variety with the sep. and pet. of a more yellowish colour, and the orange mark of the hypochile of the lip replaced by a faint red band, the front lobe of the lip is white dotted with purple. Brazil. (St. Petersburg Botanic Garden.)

**Stenandrium Lindeni,** N. E. Br. (*Ill. H.* vol. 38, p. 91, pl. 136.) Acanthaceæ. S. A pretty foliage plant of dwarf habit, with elliptic obtuse l., dark green, shading into paler green towards the centre and marked with yellow veins. Fl. yellow in erect cylindric spikes. Peru. (L'Horticulture Internationale.)

***Stenoglottis longifolia,** Hook., f. (*B. M.* t. 7186.) Orchideæ. S. A pretty terrestrial orchid with the habit of *Habenaria.* Leaves 6 in. long, scape erect, 18 in. high, upper half clothed with deep mauve flowers with fimbriated labellum. Natal. (Kew.)

***Streptocarpus Galpini,** Hook. f. (*G.C.* 1891, x., p. 546; *G. and F.* iv., p. 534; *J. of H.* 1891, Nov., p. 388.) Gesneraceæ. G. A new species of the monophyllous section. Fl. nearly 1½ in. across, campanulate, and coloured rich mauve-blue with a conspicuous white eye. Transvaal. (Kew.)

***Synantherias sylvatica,** Schott. (*B. M.* t. 7190.) Aroideæ. S. This is the name accepted by Sir Joseph Hooker for the plant cultivated as *Amorphophallus zeylanicus, Arum sylvaticum,* &c. (Kew.)

**Tamarix odessana,** Stev. (*Nat. Arb. Zösch.* 1891, p. 27; *G. C.* 1891, vol. 9, p. 462.) Tamariscineæ. A species found wild in the neighbourhood of Odessa. (Zöschen Arboretum.)

**Thrinax Morrisii,** Wendland. (*G. C.* 1891, ix., p. 700, fig. 134.) Palmæ. S. A small species, not exceeding 3 ft. in height, discovered by Mr. D. Morris, F.L.S., in Anguilla. Fresh seeds have been obtained for Kew.

**Thunia mastersiana,** Kränzlin. (*G. C.* 1891, x., p. 420; *Gfl.* 1891, p. 610.) Orchideæ. S. A new species with stems 4 ft. high and leaves 1 ft. long. Flowers about half the size of those of *T. alba.* Moulmien. (Sander & Co.)

**Tragopyrum lanceolatum,** Bieb. var. **latifolia,** Led. (*Gfl.* 1891, p. 169, t. 1344, f. 1–3.) Polygonaceæ. H. shr. A form with broad leaves. Russia and Central Asia. (St. Petersburg Botanic Garden.)

**Trichocentrum triquetrum,** Rolfe. (*G. C.* 1891, ix., p. 701; *Gfl.* 1891, p. 390.) Orchideæ. S. A new species with the habit of an Iris, 6 in. high, the flowers straw-coloured, lip variegated with orange. Ovary triquetrous, spur $1\frac{1}{4}$ in. long. Peru. (Charlesworth, Shuttleworth & Co.)

**Trochetia blackburneana,** Bojer. (*B. M.* t. 7209.) Sterculiaceæ. S. A Hibiscus-like shrub with obovate leaves and drooping axillary cupped flowers, 1 in. across, coloured white and crimson. Mauritius. (Trinity College Botanic Garden, Dublin.)

***Tulbaghia natalensis,** Baker. (*G. C.* 1891, ix., p. 668.) Liliaceæ. G. Resembles *T. alliacea* in leaf and habit, but has the perianth segments longer than the tube. Flowers greenish-white, fragrant. Natal. (Kew.)

***Tulipa Sintenisii,** Baker. (*G. C.* 1891, vol. i., p. 330; *B. M.* 7193; *W. G.* 1891, p. 156.) Liliaceæ. H. A curious dwarf Tulip nearly allied to *T. undulatifolia*, but differing chiefly in more blunt perianth segments, and flat leaves. Fl. pale glaucous red and scarlet with black blotch on claw. March. Turkish Armenia. (Kew.)

**Vitis multifida gracilis,** Carr. (*R. H.* 1891, p. 206.) Ampelideæ. H. Vine of much branched habit, with very slender stems, and deeply lobed l. Grapes black, in small bunches. China.

**Vitis Romaneti,** Carr. vars. **obtusifolia** and **serotina,** Carr. (*R. H.* 1891, p. 520–522, f. 134–136.) H. Vines. The var. **obtusifolia** has the l. cordate and nearly entire, and covered with a white tomentum. The "variety" **serotina** appears to be merely the female plant which ripens its fr. late. China.

**Vriesea cardinalis,** Duval. (*Ill. H.* vol. 38, p. 39, pl. 125.) Bromeliaceæ. S. A garden hybrid between *V. brachystachys* and *V. Krameri.* (Duval, Versailles.)

**Vriesea insignis,** Witte. (*Gfl.* 1891, p. 476.) S. A garden hybrid between *V. Barilleti* and *V. splendens.* (Jacob-Makoy.)

***Wahlenbergia undulata,** Cham. (*B. M.* t. 7174.) Campanulaceæ. A straggling herbaceous plant with thin stems, linear oblong leaves and terminal campanulate flowers an inch deep and wide; colour, violet-blue. S. Africa. (Kew.)

**Wellingtonia pyramidata compacta,** Carr. (*R. H.* 1891, p. 166.) Coniferæ. H. A garden variety of compact pyramidal growth. (Otin & Sons, St. Étienne.)

**Zea tunicata foliis variegatis,** Dam. (*W. G.* 1891, p. 457.) Gramineæ. G. or H. H. annual. A garden variety of *Z. Mays* with variegated leaves. (Dammann & Co.)

**Zygopetalum Lindeniæ,** Rolfe. (*L.* vol. 6, p. 73, pl. 275.) S. A distinct species with narrow, lanceolate acute sep. and pet. of a light rosy colour, and a large ovate acute lip, white with very numerous rose-coloured veins, crest large and thick, rather darker. Venezuela. (L'Horticulture Internationale.)

# ROYAL GARDENS, KEW.

# BULLETIN

OF

# MISCELLANEOUS INFORMATION.

APPENDIX III.—1892.

**LIST of the STAFFS of the ROYAL GARDENS, Kew, and of Botanical Departments and Establishments at Home, and in India and the Colonies, in Correspondence with Kew.**

* Trained at Kew. † Recommended by Kew.

## Royal Gardens, Kew:—

| | |
|---|---|
| Director - - - | W. T. Thiselton-Dyer, C.M.G., C.I.E., F.R.S., Ph.D., F.L.S. |
| Assistant-Director - - | Daniel Morris, M.A., F.L.S. |
| Assistant (Office) - - | John Aikman. |
| ,, ,, - - | William Nicholls Winn. |

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|---|---|
| Keeper of Herbarium and Library | John Gilbert Baker, F.R.S., F.L.S. |
| Principal Assistant - - | William Botting Hemsley, F.R.S., A.L.S. |
| Mycologist - - - | M. Cubitt Cooke, M.A., LL.D., A.L.S. |
| Assistant (Herbarium) - | Nicholas Edward Brown, A.L.S. |
| ,, ,, - - | Robert Allen Rolfe, A.L.S. |
| ,, ,, - - | Charles Henry Wright. |
| ,, for India - - | Otto Stapf, Ph.D. |
| Attendant - - - | John Frederick Jeffrey. |

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|---|---|
| Honorary Keeper, Jodrell Laboratory | Dukinfield Henry Scott, M.A., Ph.D., F.L.S. |

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|---|---|
| Curator of Museums | John Reader Jackson, A.L.S. |
| Assistant (Museum) | John Masters Hillier. |
| Preparer | George Badderly. |

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|---|---|
| Curator of the Gardens | George Nicholson, A.L.S. |
| Assistant-Curator | William Watson. |
| Foremen:— | |
| Arboretum | William J. Bean. |
| Herbaceous Department | Daniel Dewar. |
| Greenhouse and Ornamental Department. | Frank Garrett. |
| Temperate House (Sub-tropical Department). | Thomas Jones. |

**Cambridge.**—University Botanic Garden:—

| | |
|---|---|
| Professor | Charles C. Babington, F.R.S., F.L.S. |
| Secretary to Botanic Garden Syndicate. | Francis Darwin, M.B., F.R.S., F.L.S. |
| Curator | *Richard Irwin Lynch, A.L.S. |

**Dublin.**—Royal Botanic Gardens, Glasnevin:—

| | |
|---|---|
| Curator | Frederick W. Moore, Cor. Mem. R.H.S. |

Trinity College Botanic Gardens:—

| | |
|---|---|
| Professor | E. Perceval Wright, M.D., F.L.S., Sec. R.I.A. |
| Curator | *F. W. Burbidge, M.A., F.L.S. |

**Edinburgh.**—Royal Botanic Gardens:—

| | |
|---|---|
| Regius Keeper | Isaac Bayley Balfour, M.D., D.Sc., F.R.S., F.L.S. |
| Curator | Robert Lindsay, F.R.H.S. |

**Glasgow.**—Botanic Gardens:—

| | |
|---|---|
| University Professor | F. O. Bower, D.Sc., F.R.S., F.L.S. |
| Curator | ——— |

**Oxford.**—University Botanic Garden:—

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|---|---|
| Professor | Sydney H. Vines, D.Sc., F.R.S., F.L.S. |
| Curator | *William Baker, F.R.H.S. |

# COLONIES.

**Antigua.** (*See* Leeward Islands.)

**Barbados.**—Dodd's Reformatory, Botanical Station :—

| | | |
|---|---|---|
| | Superintendent - | John R. Bovell, F.C.S. |

**British Guiana.**—Botanical Gardens :—

| | | |
|---|---|---|
| Georgetown - | Superintendent and Government Botanist. | *George S. Jenman, F.L.S. |
| | Head Gardener - | †John F. Waby. |
| | Second „ - | *Robert Ward. |
| | Promenade Garden :— | |
| | Head Gardener - | William Jackson. |
| Berbice - - | Keeper - - | Richard Hunt. |

**British Honduras.**—Botanical Station.

| | | |
|---|---|---|
| | Curator - | †James McNair. |

**Canada.**—

| | | |
|---|---|---|
| Ottawa - - | Dominion Botanist - | Prof. John Macoun, M.A., F.R.S.C., F.L.S. |
| | Assistant „ - | Jas. M. Macoun. |
| | Director of Government Experimental Farms. | Prof. Wm. Saunders, F.R.S.C., F.L.S. |
| | Botanist and Entomologist. | James Fletcher, F.L.S. |
| Montreal - | Director, Botanic Garden. | Prof. Penhallow, B.Sc. |

**Cape Colony.**—

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|---|---|---|
| | Government Botanist - | Prof. MacOwan, F.L.S. |
| Gardens and Public Parks:— | | |
| Cape Town - | Curator - - | H. J. Chalwin. |
| Grahamstown - | Curator - - | Edwin Tidmarsh. |
| Port Elizabeth (St. George's Park) :— | | |
| | Superintendent - | John T. Butters. |
| King Williamstown | Curator - - | *T. R. Sim. |
| Graaf Reinet - | „ - - | J. C. Smith. |
| Uitenhage - | „ - - | H. Fairey. |

**Ceylon.**—Department of Royal Botanical Gardens :—

| | | |
|---|---|---|
| | Director - - | †Henry Trimen, M.B., F.R.S., F.L.S. |
| Peradeniya - | Head Gardener - | *Peter D. G. Clark. |
| | Clerk and Foreman | J. A. Ferdinandus. |
| | Draughtsman - | W. de Alwis. |
| Hakgala - | Superintendent - | *William Nock. |
| | Clerk and Foreman - | M. G. Perera. |
| Henaratgoda - | Conductor - - | A. de Zoysa, Muhandiram. |
| Anurâdhapura - | „ - - | S. de Silva, Arachchi. |
| Badulla - - | „ - - | D. Guneratne. |

**Dominica.** (*See* Leeward Islands.)

**Fiji.**—Botanical Station :—

| | | |
|---|---|---|
| | Curator | *Daniel Yeoward. |

**Gold Coast.**—Botanical Station :—

| | | |
|---|---|---|
| | Curator | *William Crowther. |

**Grenada.**—Botanical Garden :—

| | | |
|---|---|---|
| | Curator | †George W. Smith. |

**Hong Kong.**—Botanical and Afforestation Department :—

| | | |
|---|---|---|
| | Superintendent | †Charles Ford, F.L.S. |
| | Assistant Superintendent. | *W. J. Tutcher. |

**Jamaica.**—Department of Public Gardens and Plantations :—

| | | |
|---|---|---|
| | Director | †William Fawcett, B.Sc., F.L.S. |
| **Hope Gardens** | Superintendent | *William Cradwick. |
| **Castleton Garden** | ,, | Eugene Campbell |
| **Cinchona (Hill) Garden.** | ,, | *William Harris. |
| **Kingston Parade Garden.** | ,, | Joseph Harris. |
| **King's House Garden.** | ,, | *William J. Thompson. |
| **Bath** | Overseer | W. Groves. |

**Lagos.**—Botanical Station :—

| | | |
|---|---|---|
| | Curator | *Henry Millen. |

**Leeward Islands.**—Agricultural Department :—

| | | |
|---|---|---|
| | Superintendent | †Charles A. Barber, M.A., F.L.S. |
| Botanical Stations :— | | |
| **Antigua** | Curator | *Arthur G. Tillson. |
| **Dominica** | ,, | *Joseph Jones. |
| **Montserrat** | ,, | Joseph Wade. |
| **St. Kitts—Nevis** | ,, | *Charles Plumb. |

**Malta.**—Botanical Garden :—

| | | |
|---|---|---|
| | Director | Dr. Francesco Debono. |

**Mauritius.**—Department of Forests and Botanical Gardens :—

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| **Pamplemousses** | Director | ——— |
| | Assistant | *William Scott. |
| **Curepipe** | Overseer | William A. Kennedy. |

**Montserrat.** (*See* Leeward Islands.)

**Natal.**—Botanical Gardens :—

| | | |
|---|---|---|
| **Durban** | Curator | John Medley Wood. A.L.S. |
| | Head Gardener | *James Wylie. |
| **Pietermaritzburg** | Curator | G. Mitchell. |

**New South Wales.**—Botanical Gardens :—

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| **Sydney** | Director | Charles Moore, F.L.S. |

## New Zealand :—

**Wellington.**—Colonial Botanic Garden :—

| | | |
|---|---|---|
| | Director - | Sir James Hector, K.C.M.G., F.R.S. |
| | Head Gardener | G. Gibb. |
| **Dunedin** | Superintendent | J. McBean. |
| **Napier** | „ | W. Barton. |
| **Invercargill** | Head Gardener | Thomas Wangle. |
| **Auckland** | Ranger | William Goldie. |
| **Christchurch** | Head Gardener | *Ambrose Taylor. |

## Queensland.—Botanical Department :—

| | | |
|---|---|---|
| **Brisbane** | Colonial Botanist | F. M. Bailey, F.L.S. |
| Botanical Gardens :— | | |
| | Curator | *Philip MacMahon. |
| | Overseer | J. Tobin. |
| Acclimatisation Society's Gardens :— | | |
| | Secretary and Manager | Wm. Soutter. |
| | Assistant. Do. | A. Humphrey. |
| **Rockhampton** | Superintendent | J. S. Edgar. |

## St. Kitts—Nevis. (*See* Leeward Islands.)

## St. Lucia.—Botanical Station :—

| | | |
|---|---|---|
| | Curator | †John Gray. |

## St. Vincent.—Botanical Station :—

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| | Curator | *Henry Powell. |

## South Australia.—Botanical Gardens :—

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| **Adelaide** | Director | Maurice Holtze, F.L.S. |
| **Port Darwin** | Curator | Nicholas Holtze. |

## Straits Settlements.—Gardens and Forest Department :—

| | | |
|---|---|---|
| **Singapore** | Director | †H. N. Ridley, M.A., F.L.S. |
| | Head Gardener | *Walter Fox. |
| **Penang** | Assistant Superintendent. | †Charles Curtis. |
| **Malacca** | „ | *Robert Derry. |

**Perak (Kuala Kangsar).**—Government Plantations :—

| | | |
|---|---|---|
| | Superintendent | ——— |

## Tasmania.—Botanical Gardens :—

| | | |
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| **Hobart Town** | Superintendent | F. Abbott. |

## Trinidad.—Royal Botanical Gardens :—

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| | Superintendent | †John H. Hart, F.L.S. |
| | Assistant „ | *Walter E. Broadway. |

**Tobago.**—Botanical Station :—

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| | Curator | Manuel Ribiero. |

## Victoria :—

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| **Melbourne** | Government Botanist | Sir F. von Mueller, K.C.M.G., F.R.S., F.L.S. |
| Botanical Gardens :— | | |
| | Director | W. R. Guilfoyle, F.L.S. |

## INDIA.

**Botanical Survey.**—Director, George King, M.D., LL.D., C.I.E., F.R.S., F.L.S.

**Bengal,** Assam, Burma; the Andamans and Nicobars; North-East Frontier Expeditions:—

| | |
|---|---|
| Superintendent of the Royal Botanical Gardens, Calcutta. | George King, M.D., LL.D., C.I.E., F.R.S., F.L.S. |

**Bombay,** including Sind:—

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|---|---|
| Principal of the College of Science, Poona, Bombay. | Theodore Cooke, LL.D. |

**Madras**; the State of Hyderabad and the State of Mysore:—

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| Government Botanist and Director of Cinchona Plantations. | †M. A. Lawson, M.A., F.L.S. |

**Western Provinces** and Oudh; the Punjab; the Central Provinces; Central India; Rajputana; North-West Frontier Expeditions:—

| | |
|---|---|
| Director of the Botanical Department, Northern India, Saharanpur, N.W.P. | †J. F. Duthie, B.A., F.L.S. |

**Bengal.**—Department of Royal Botanic Gardens:—

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|---|---|---|
| **Calcutta (Seebpore)** | Superintendent | George King, M.D., LL.D., C.I.E., F.R.S., F.L.S. |
| | Curator of Herbarium | Dr. David Prain, F.L.S., F.R.S.E. |
| | „ Garden | *Robert L. Proudlock. |
| | Assistant do. | *G. T. Lane. |
| **Mungpoo** | Superintendent, Government Cinchona Plantations. | George King, M.D., LL.D., C.I.E., F.R.S., F.L.S. |
| | Resident Manager | *J. A. Gammie. |
| | 1st Assistant | *R. Pantling. |
| | 2nd „ | *Joseph Parkes. |
| | 3rd „ | G. Gammie. |
| | 4th „ | *Amos Hartless. |
| **Darjeeling** | Curator, Lloyd Botanic Garden. | *William A. Kennedy. |
| **Darbhangah** | Superintendent, Maharajah's Garden. | Herbert Thorn. |

**Bombay.**—

| | | |
|---|---|---|
| **Poona** | Principal, College of Science (in charge of Botanical Survey). | Theodore Cooke, LL.D. |
| | Lecturer on Botany | *G. Marshall Woodrow. |

**Ghorpuri.**—Botanical Garden:—

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|---|---|
| Superintendent | A. R. Lister. |

**Bombay.**—Municipal Garden:—

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| Superintendent | ——— |

**Madras.**—Botanical Department :—

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| **Ootacamund** - | Government Botanist and Director of Government Gardens, Parks, and Cinchona Plantations. | †M. A. Lawson, M.A., F.L.S. |
| | Curator of Gardens and Parks. | *Andrew Jamieson. |

**Madras.**—Agri-Horticultural Society :—

| | | |
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| | Hon. Secretary - | Col. H. W. H. Cox. |
| | Superintendent - | ——— |

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**Native States** :—

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| **Mysore (Bangalore)** | Superintendent | - *J. Cameron, F.L.S. |
| | Head Gardener | - *J. Horne Stephen. |
| **Baroda** - - | Superintendent | - *J. M. Henry. |
| **Gwalior** - - | " | - †C. Maries, F.L.S. |
| **Morvi** - - | " | - *Joseph Beck. |
| **Travancore (Trivandrum)** | " | - *Frederick James Ingleby. |
| **Udaipur** - - | " | - *T. H. Storey. |

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**North-West Provinces** :—

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| **Agra (Taj Garden)** | Superintendent | - *A. B. Westland. |
| **Allahabad** - | " | - J. Phillips. |
| **Cawnpur** - - | " | - G. H. T. Mayer. |
| **Lucknow** - - | " | - *Matthew Ridley. |
| **Saharanpur and Branch Garden, Mussoorie.** | " | - William Gollan. |

**Punjab** :—

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| **Lahore** - - | Superintendent | - J. Phillips. |
| **Simla** - - | " | - A. Parsons. |